US008166732B2

(12) **United States Patent**
Cousins et al.

(10) **Patent No.: US 8,166,732 B2**
(45) **Date of Patent: May 1, 2012**

(54) **STRETCH WRAP MACHINE WITH TOP CORNER FILM TRANSFER**

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(73) Assignee: **Cousins Packaging Inc.**, Etobicoke, Ontario (CA)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **12/793,012**

(22) Filed: **Jun. 3, 2010**
(Under 37 CFR 1.47)

(65) **Prior Publication Data**

US 2010/0236192 A1 Sep. 23, 2010

Related U.S. Application Data

(63) Continuation of application No. 11/744,012, filed on May 3, 2007, now Pat. No. 7,775,016, and a continuation-in-part of application No. PCT/IB2005/004121, filed on Nov. 3, 2005.

(60) Provisional application No. 60/821,162, filed on Aug. 2, 2006, provisional application No. 60/624,703, filed on Nov. 3, 2004.

(51) **Int. Cl.**
B65B 11/28 (2006.01)

(52) **U.S. Cl.** **53/441**; 53/211; 53/556; 53/587

(58) **Field of Classification Search** 53/399, 53/441, 556, 587, 588, 589, 211, 218
See application file for complete search history.

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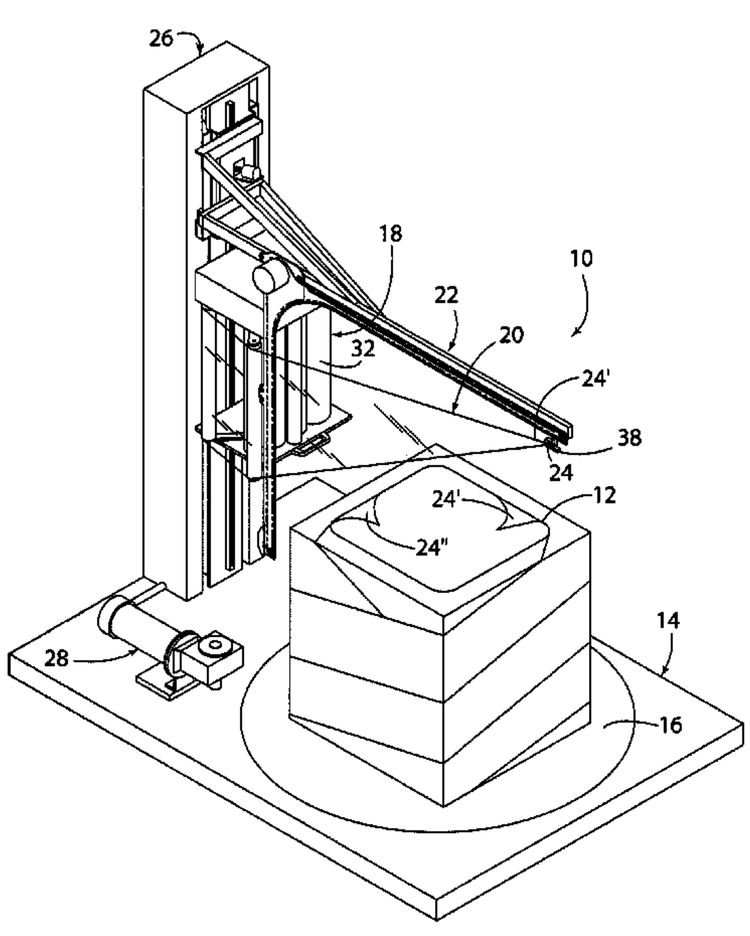
Primary Examiner — Paul Durand
(74) *Attorney, Agent, or Firm* — Flynn, Thiel, Boutell & Tanis, P.C.

(57) **ABSTRACT**

A stretch wrap machine for wrapping a product comprising a base, a turn table on the base for rotating the product, a source of stretch wrap connected to the base, and a wrapping assembly configured to bring an end of the stretch wrap above the product, cut the stretch wrap at a position above the product after the product has been wrapped and/or hold an end of the stretch wrap at a position above the product as the turntable begins rotating the product.

9 Claims, 41 Drawing Sheets



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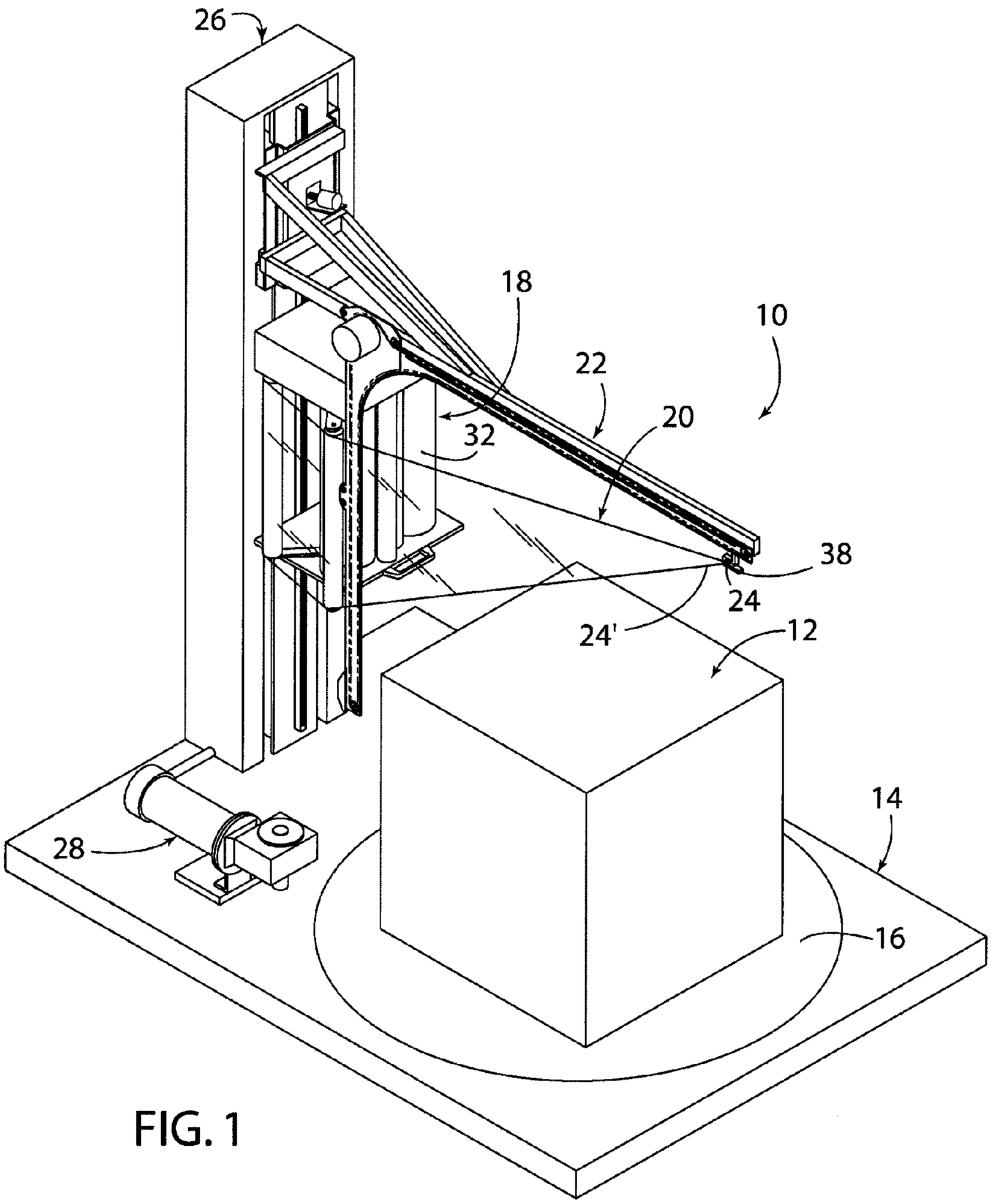

FIG. 1

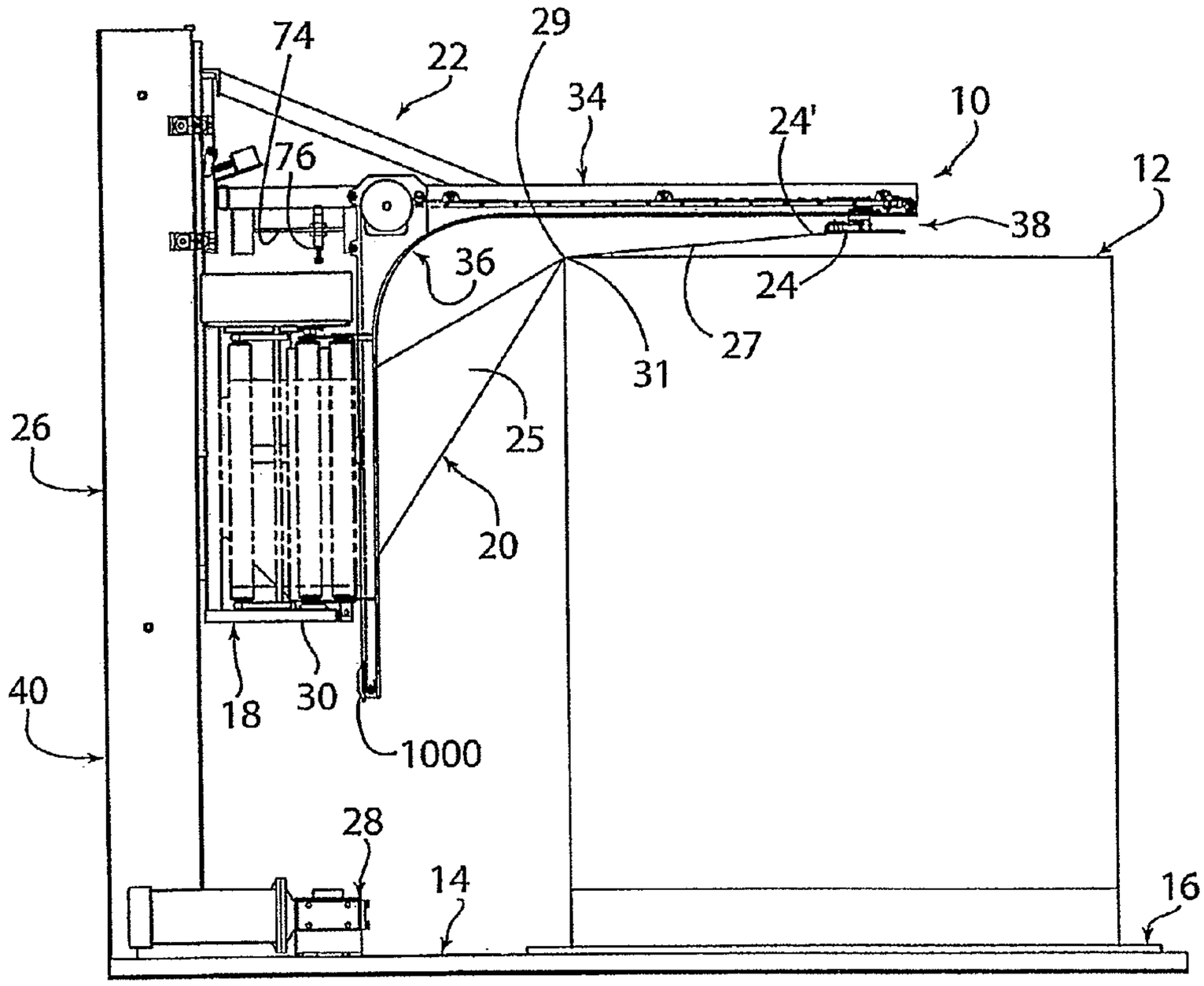

FIG. 2

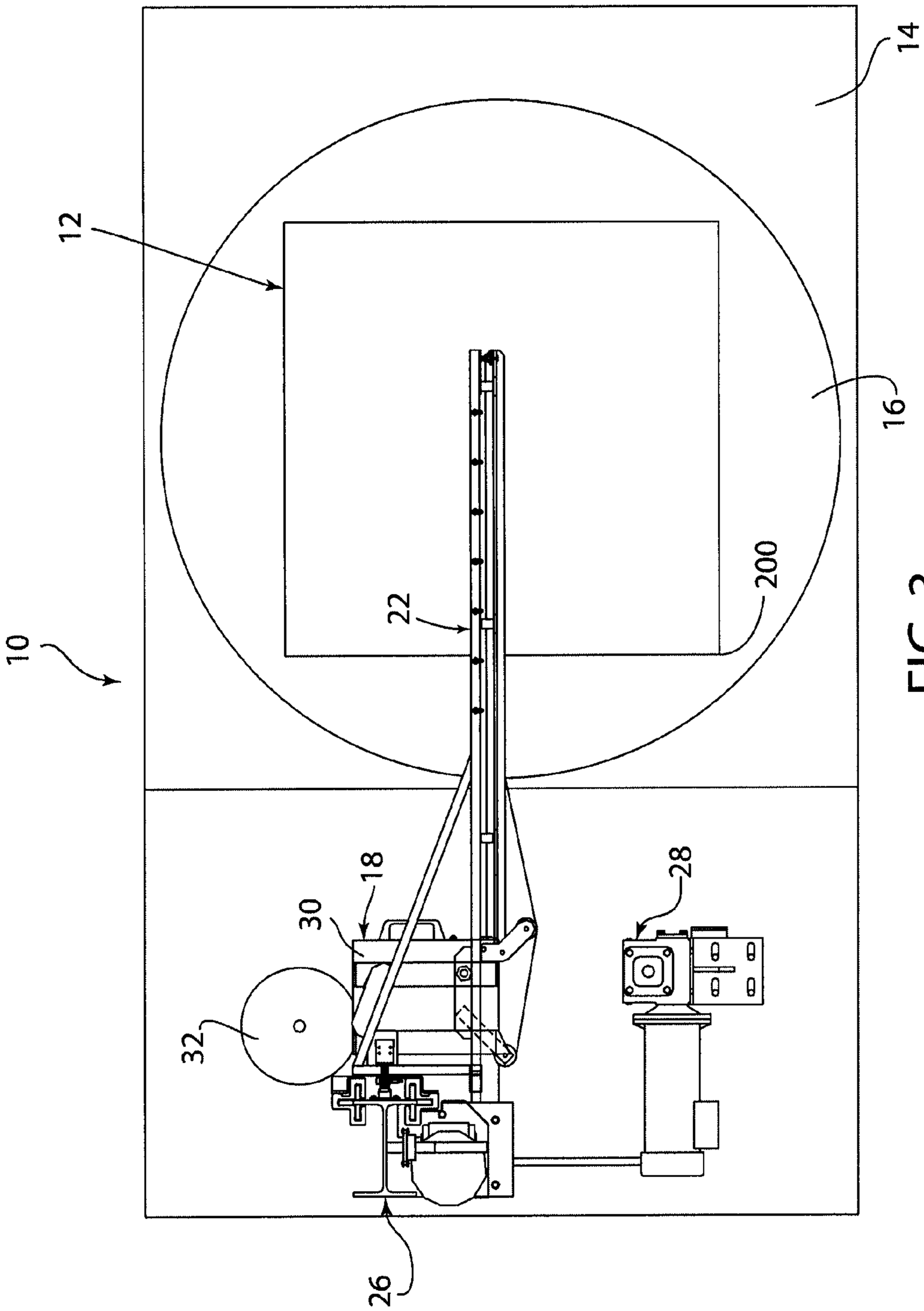

FIG. 3

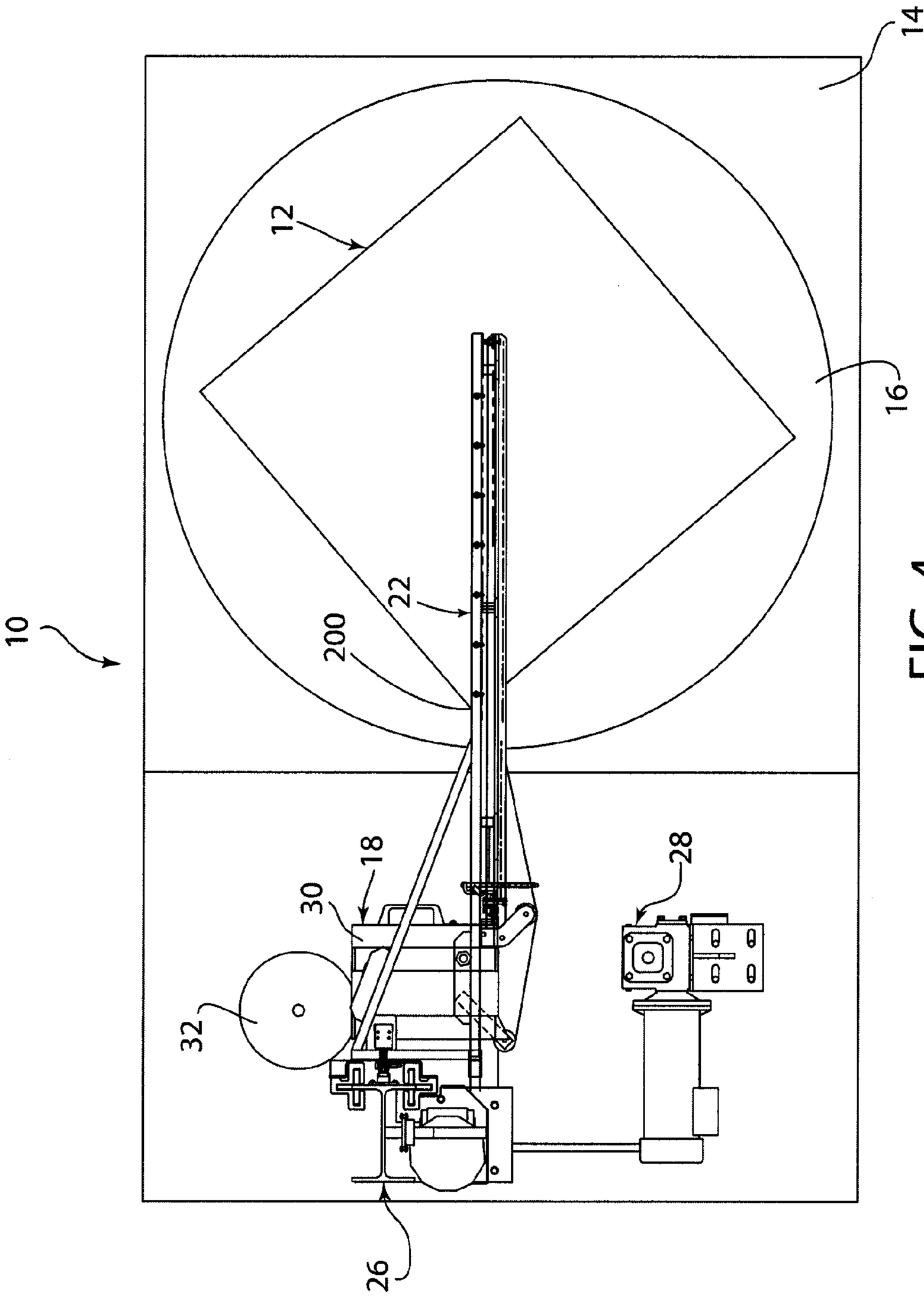

FIG. 4

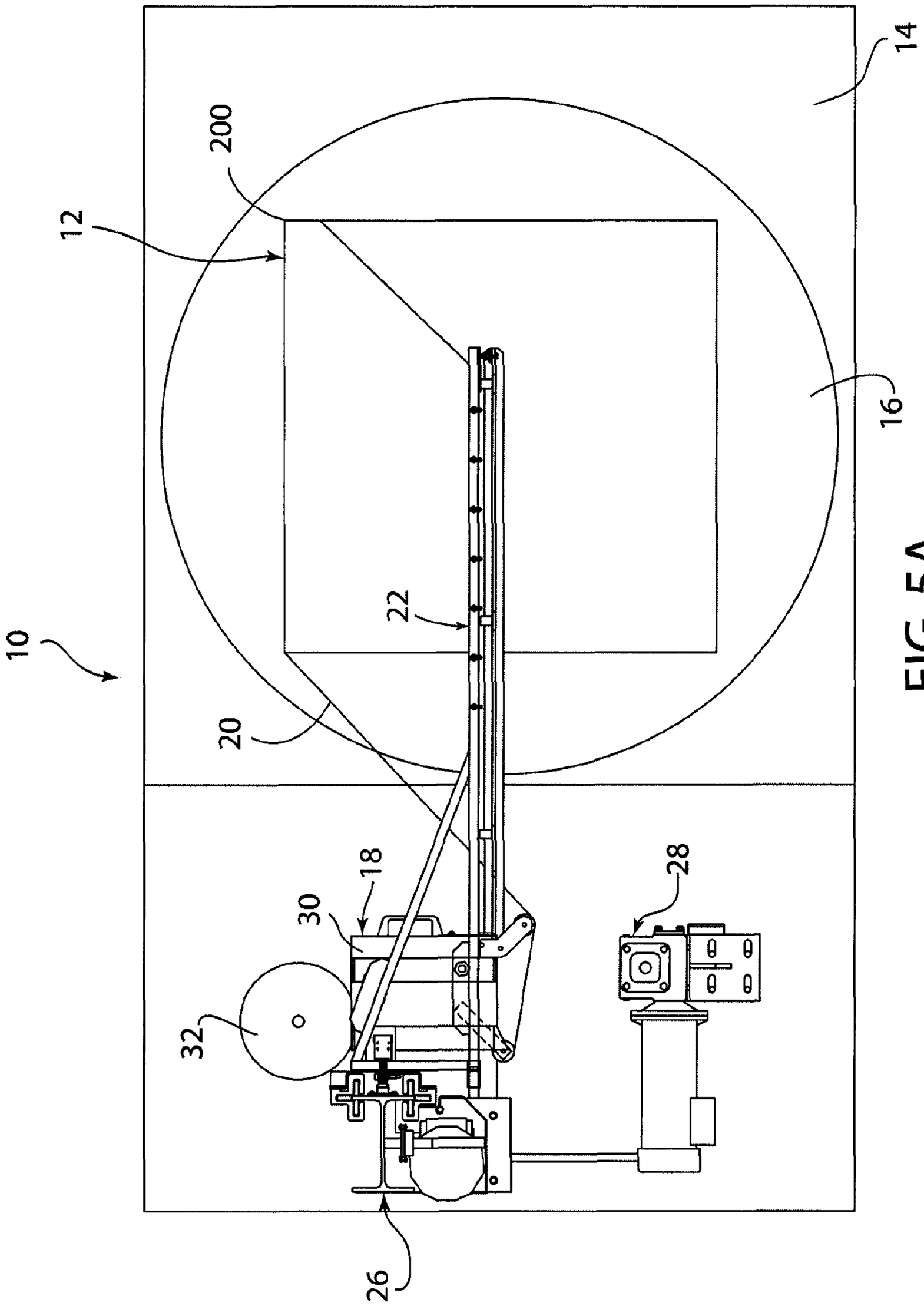

FIG.5A

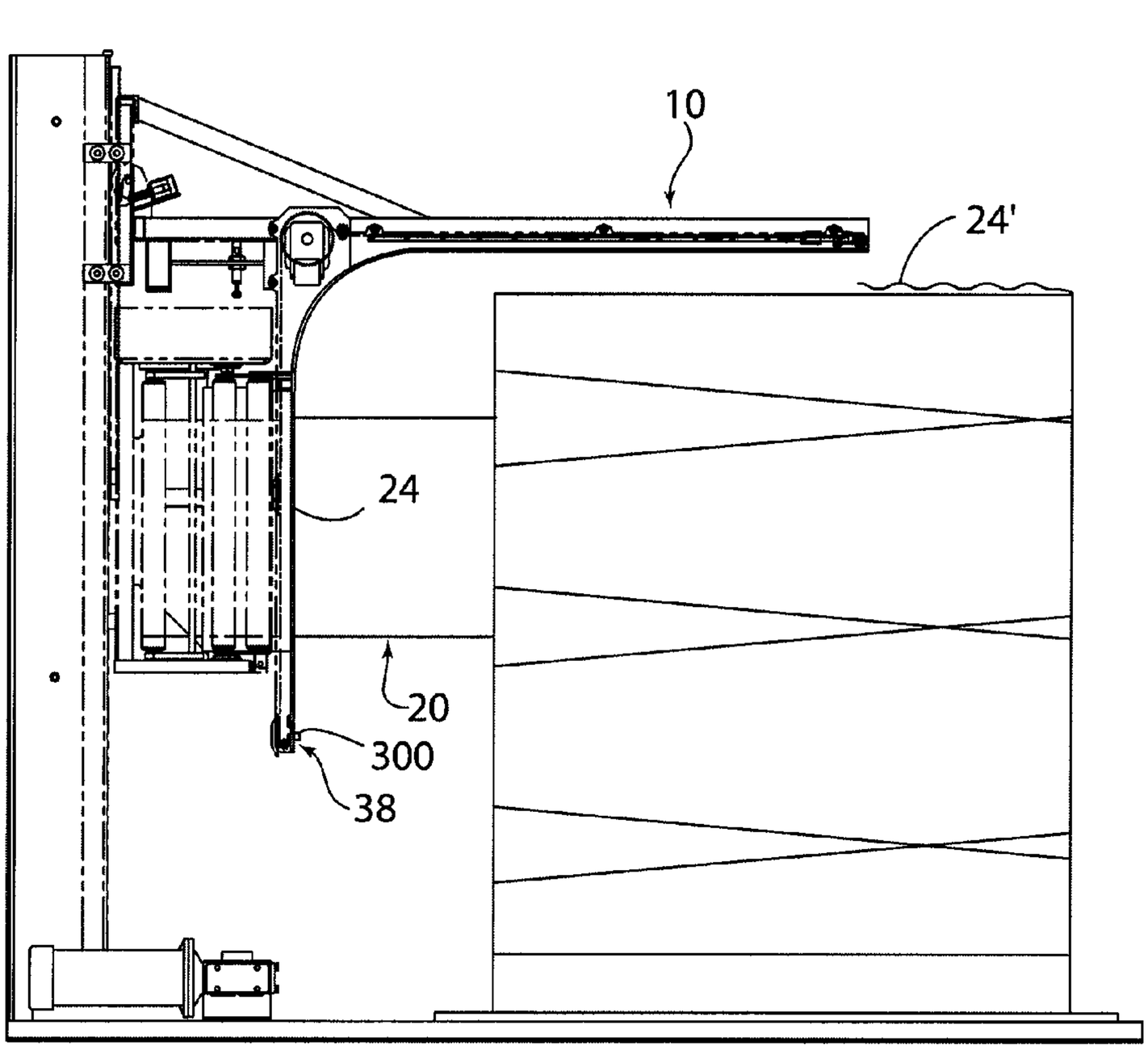

FIG. 5B

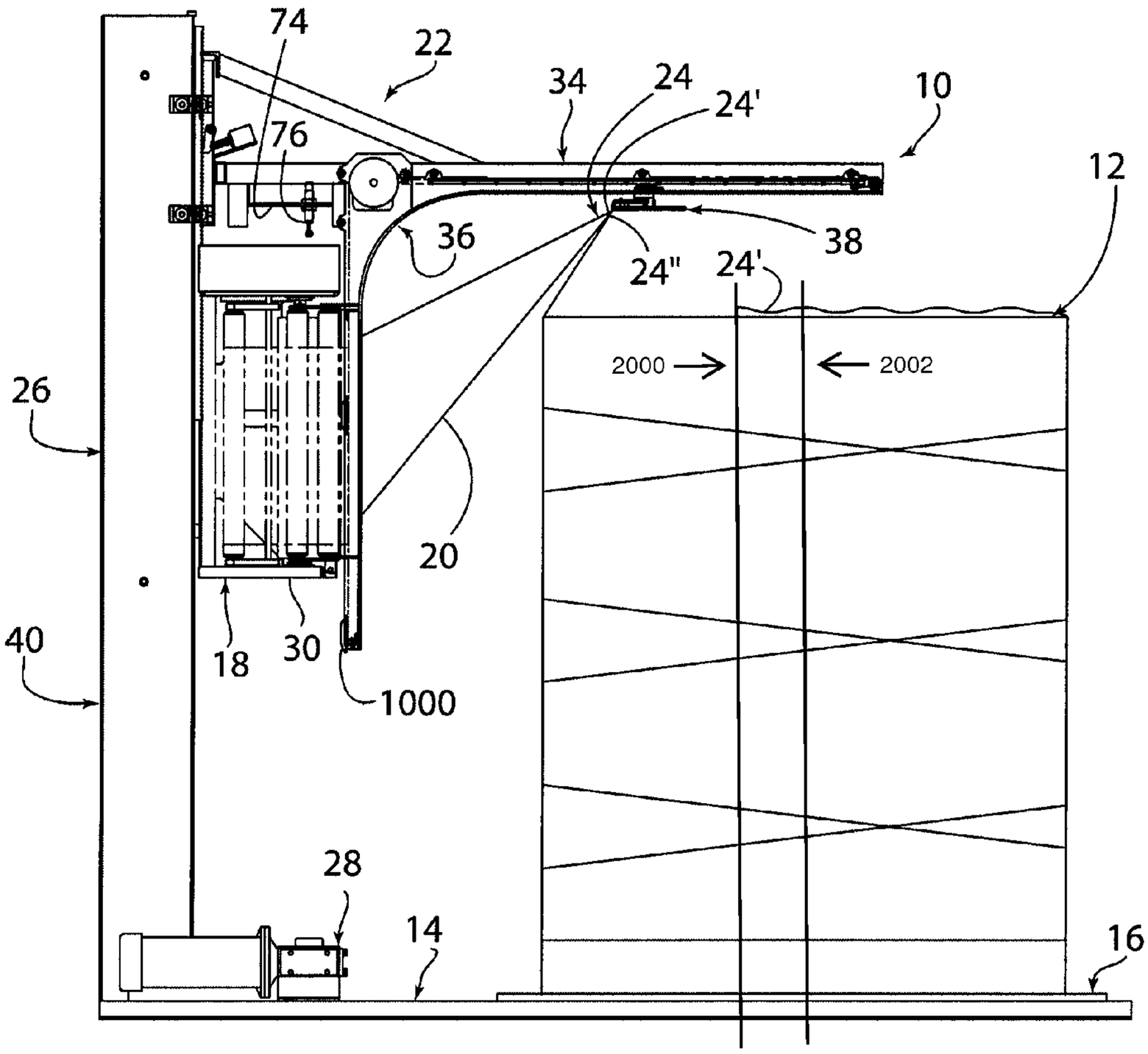
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FIG. 5C

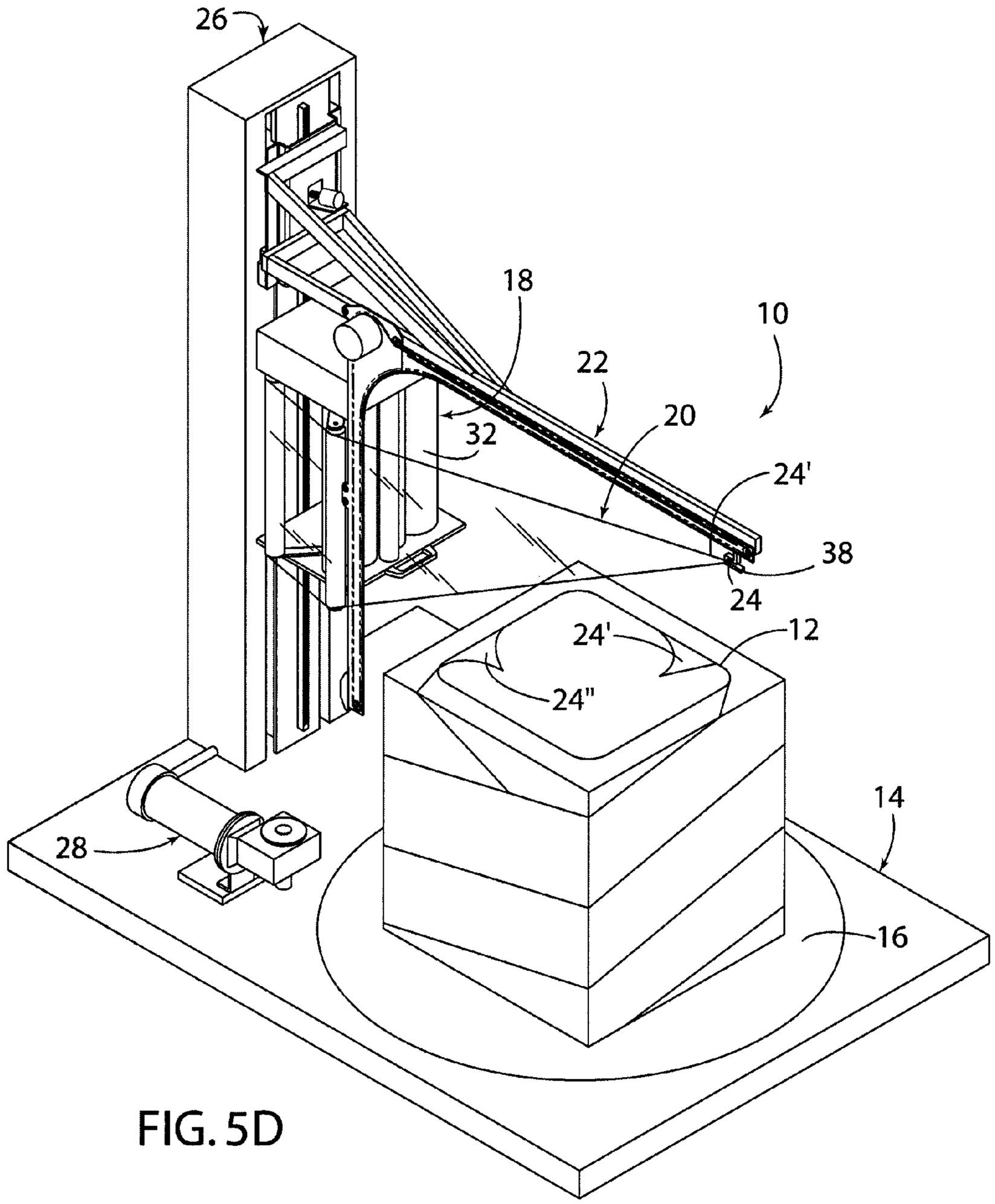


FIG. 5D

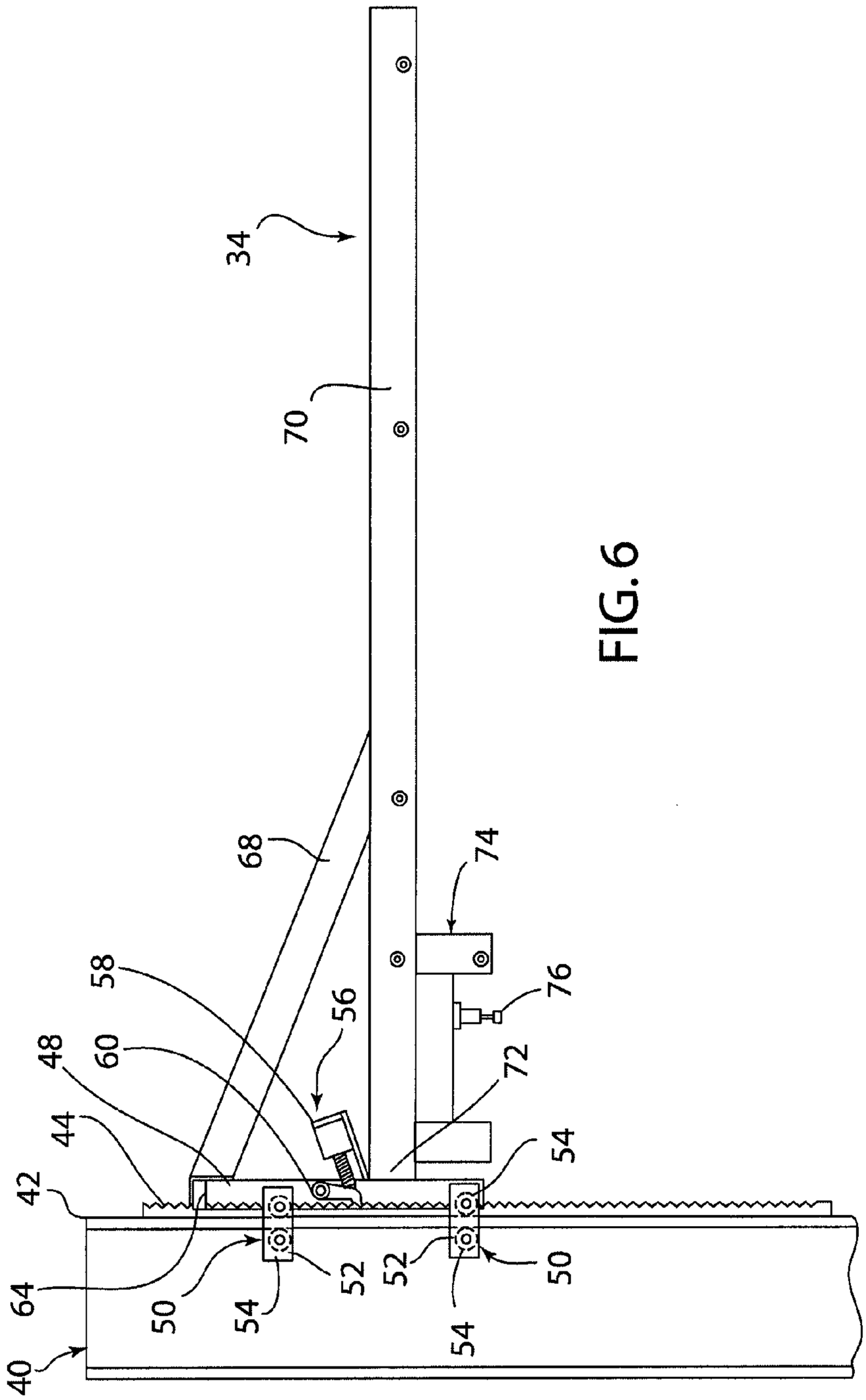
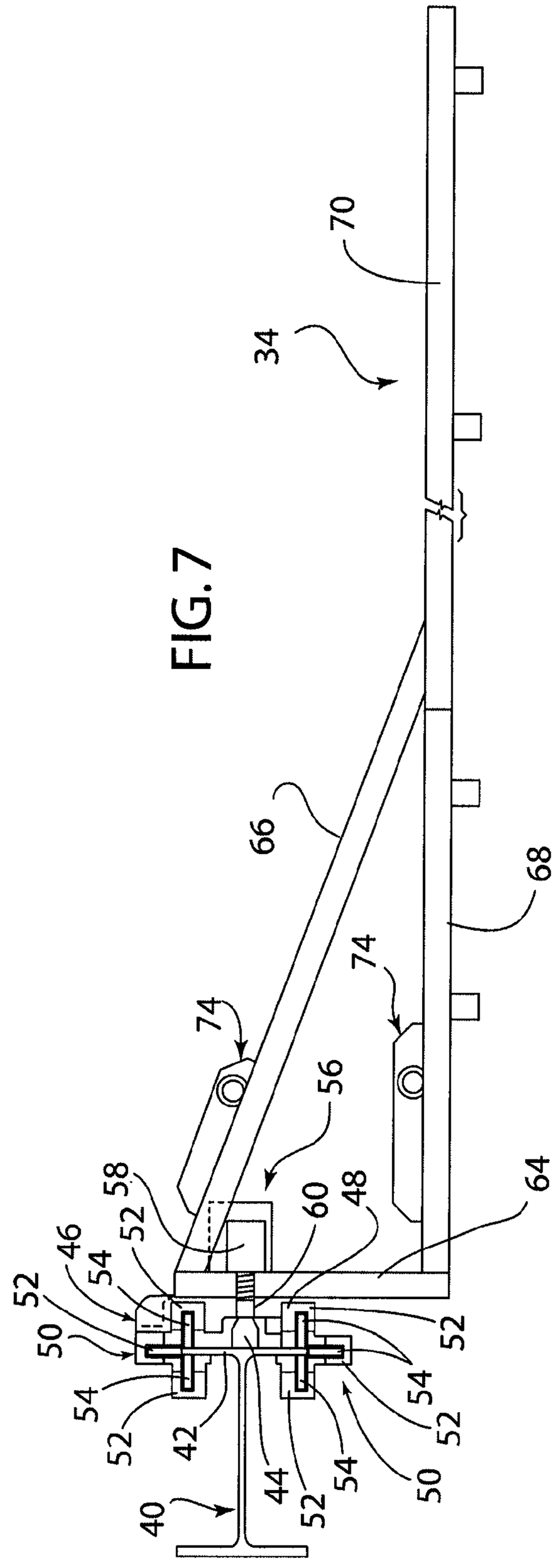


FIG.6

FIG. 7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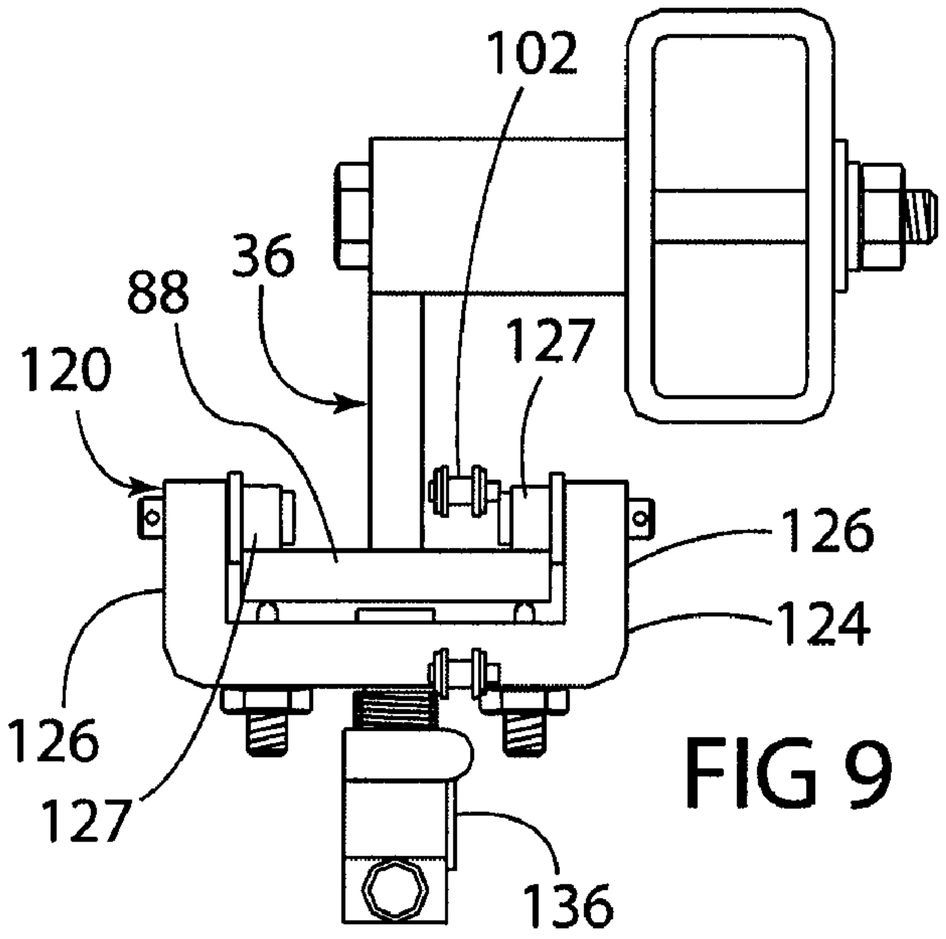
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FIG 9

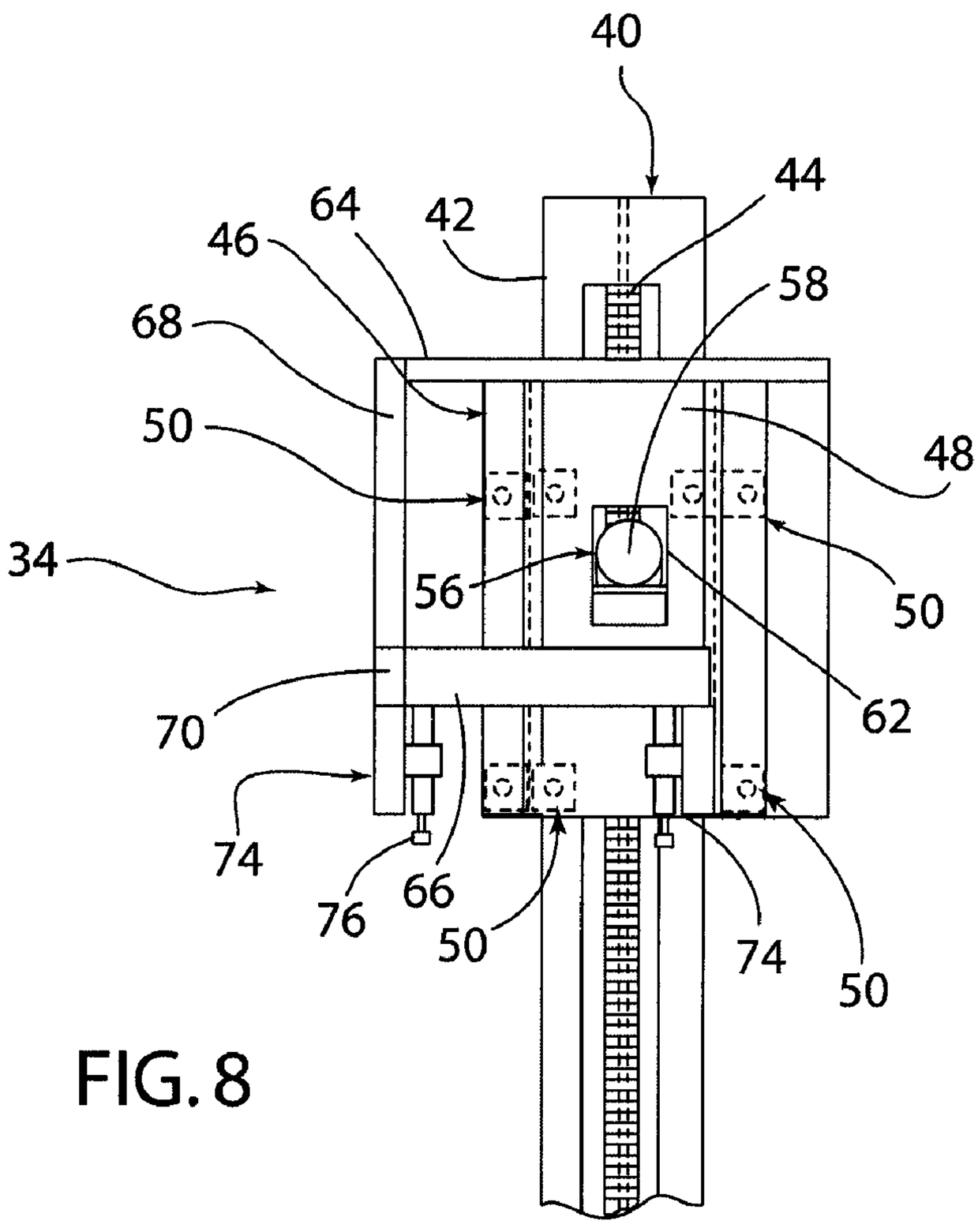
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FIG. 8

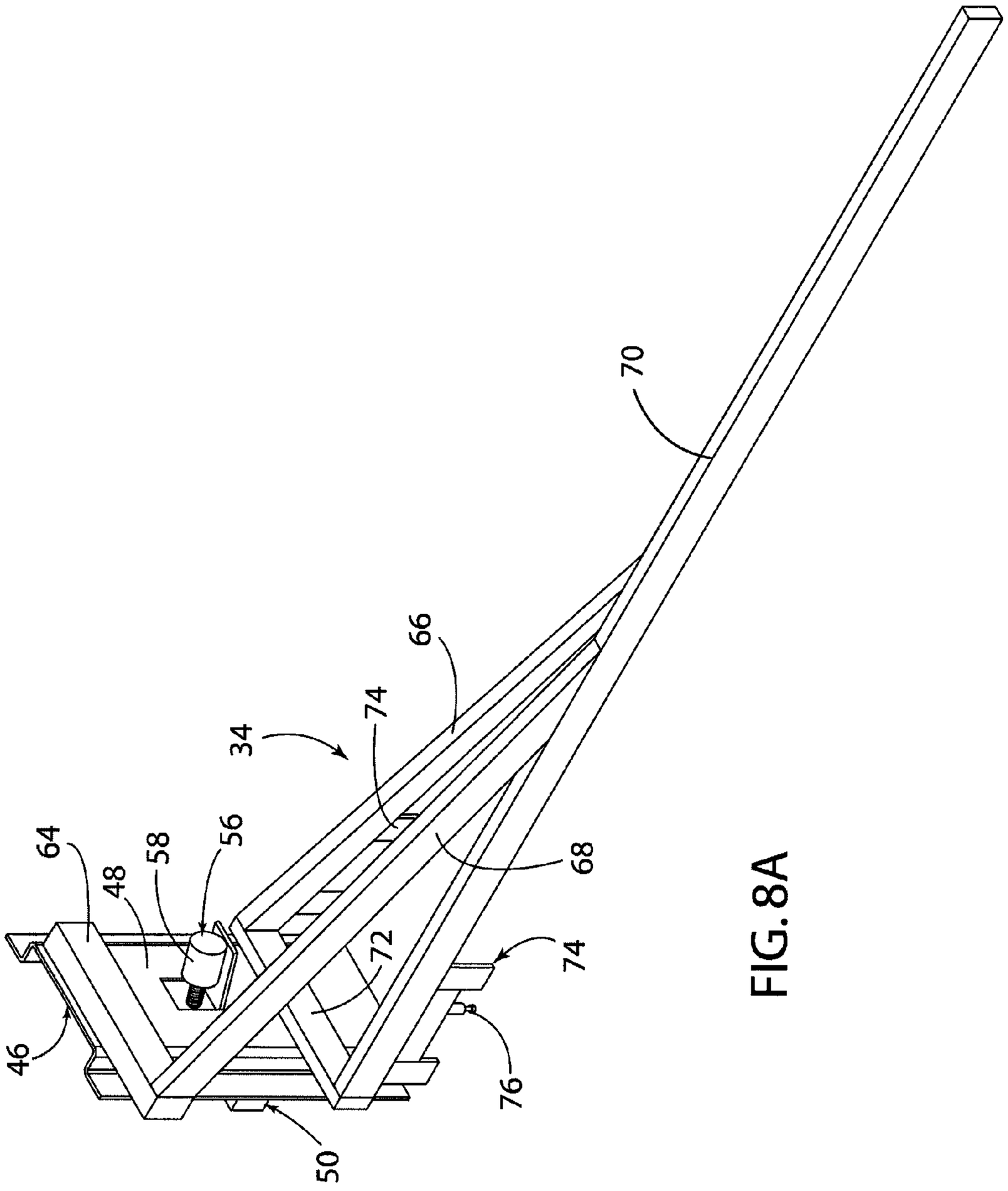


FIG. 8A

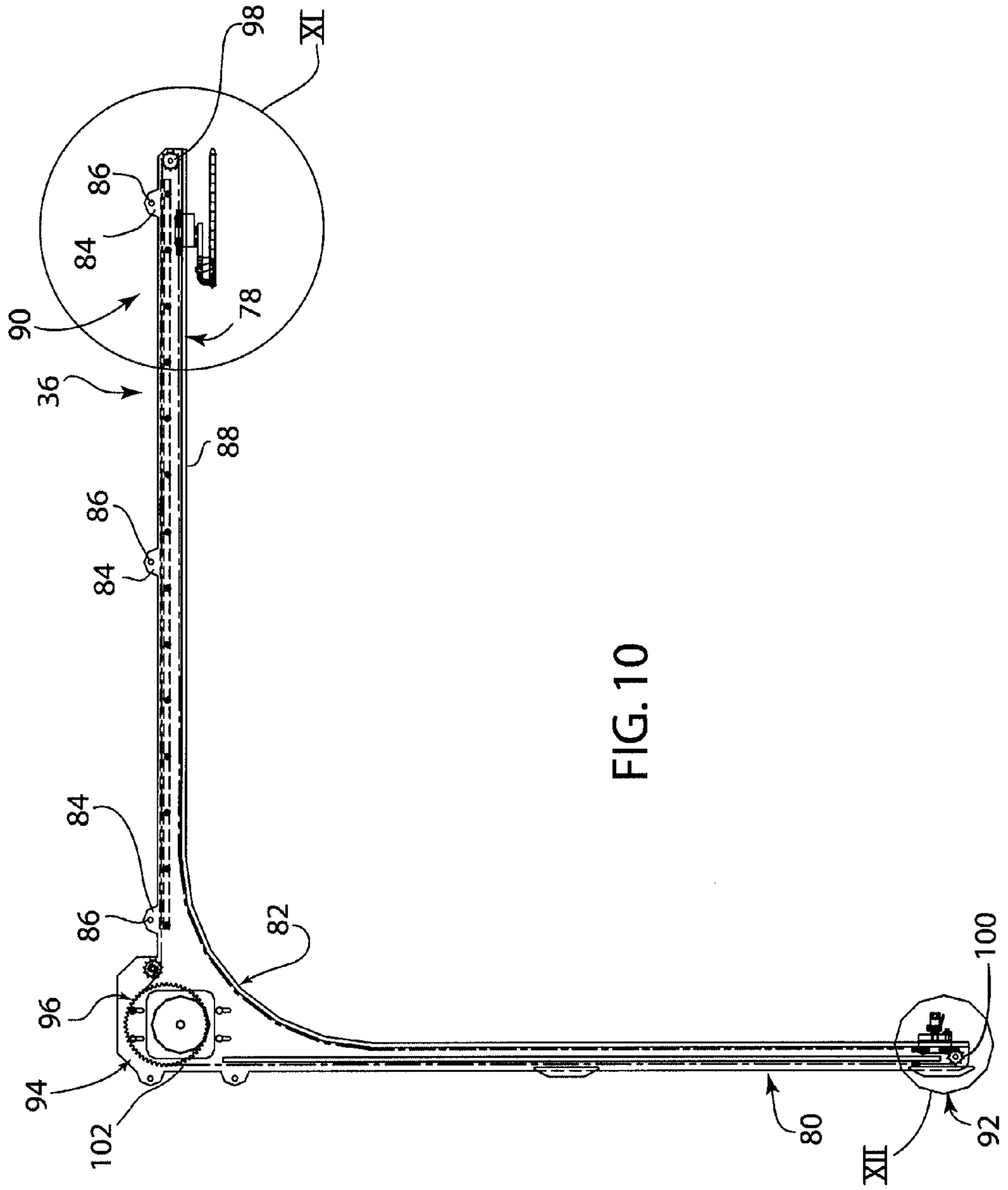
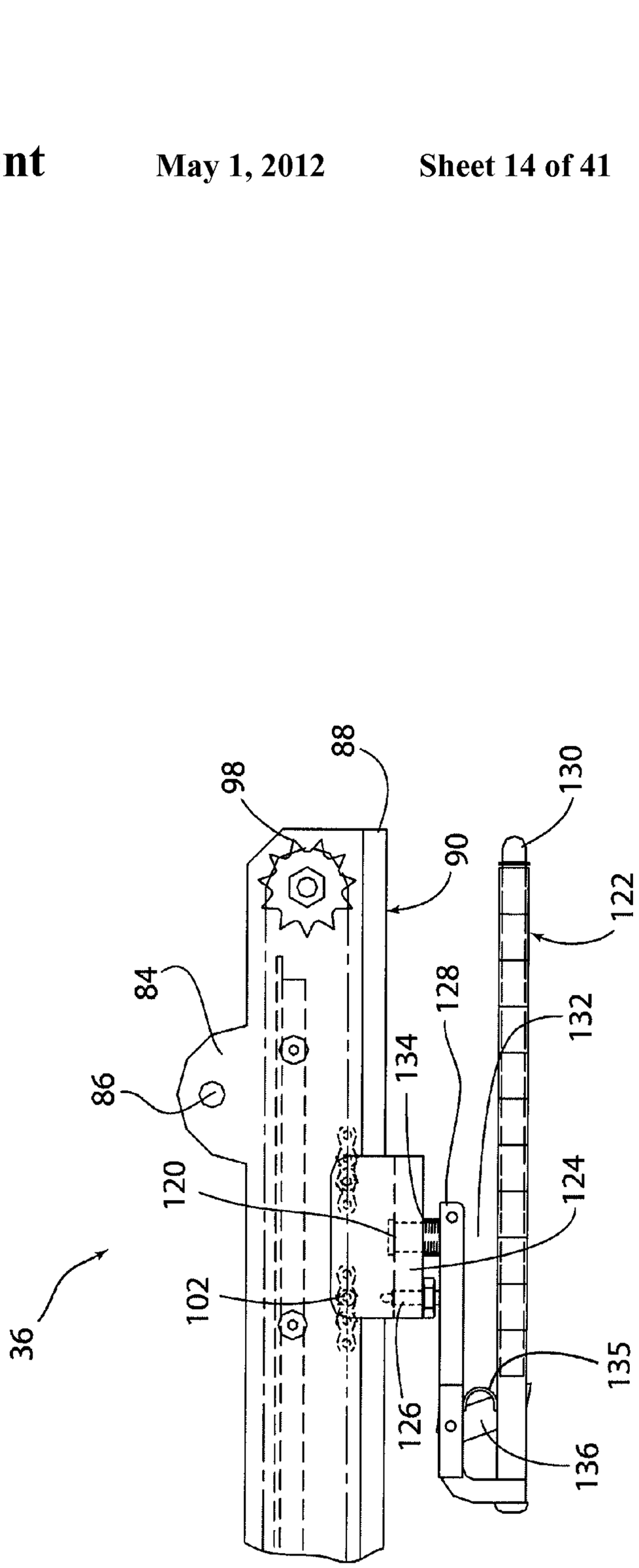


FIG. 10



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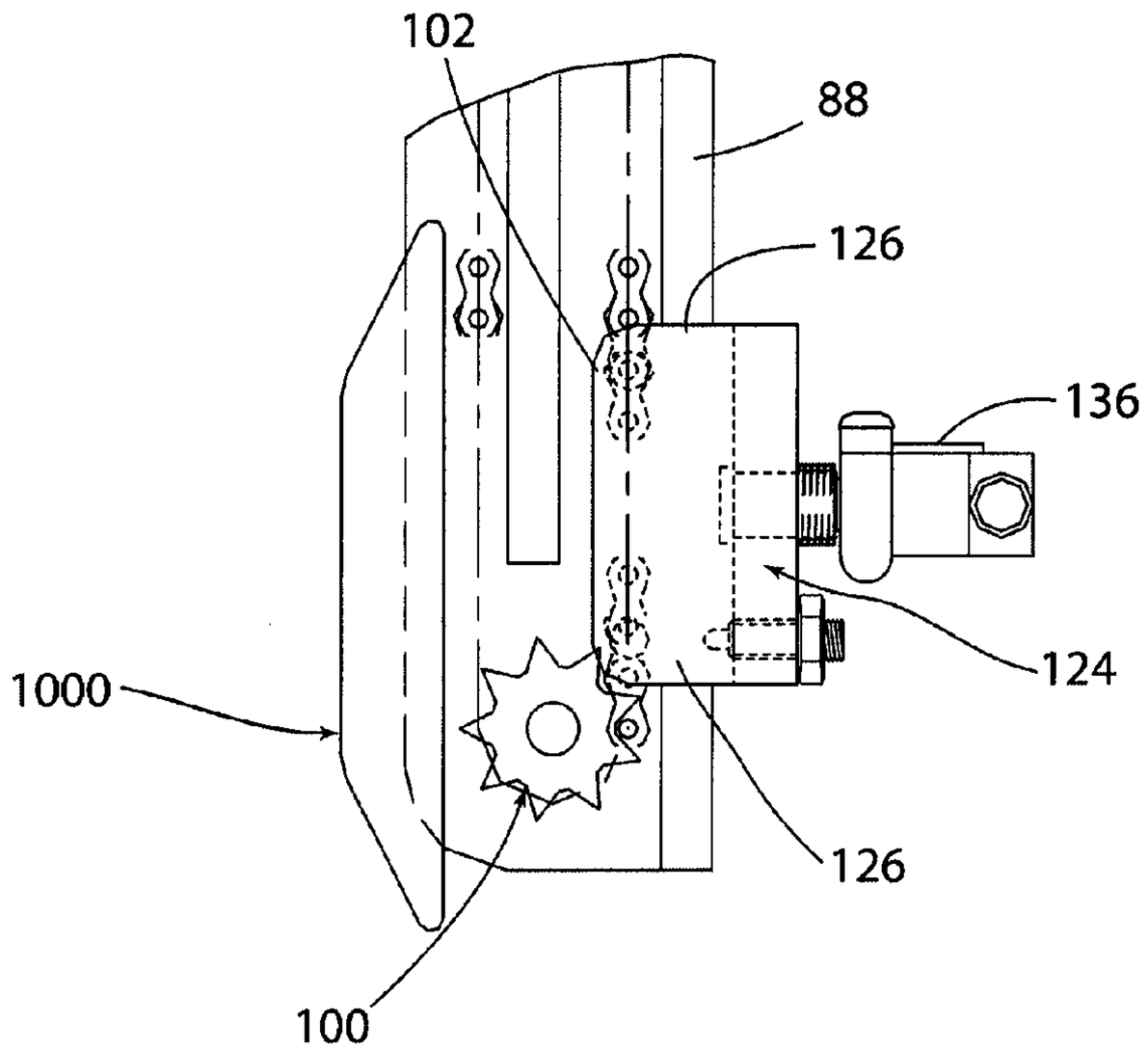


FIG.12

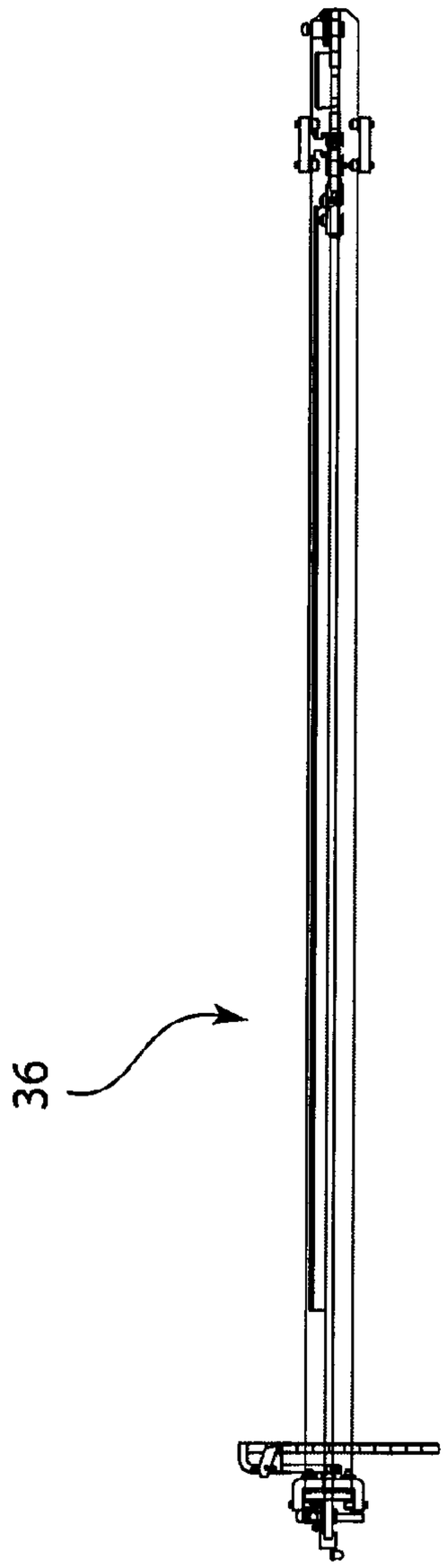
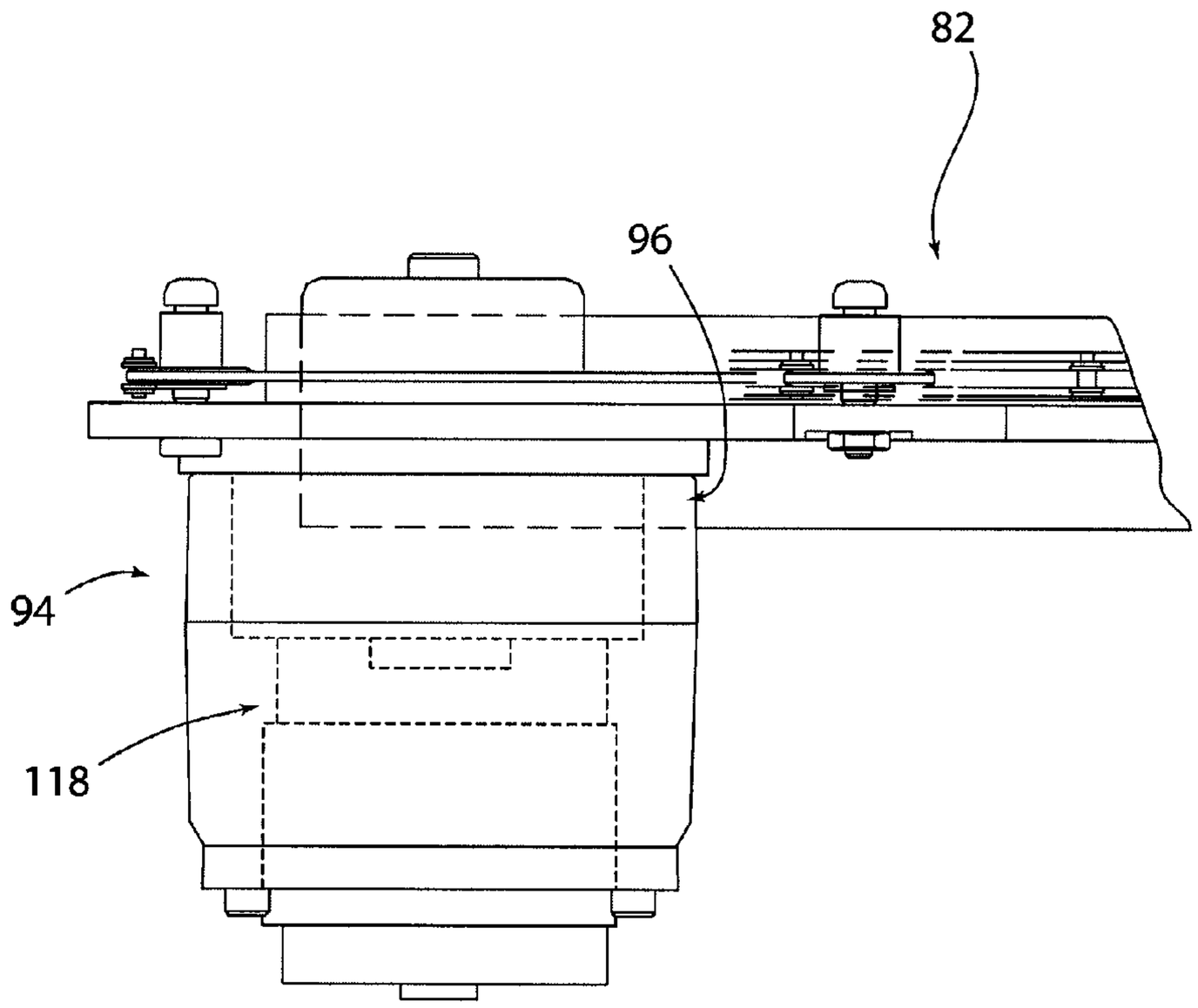


FIG. 13

FIG.14



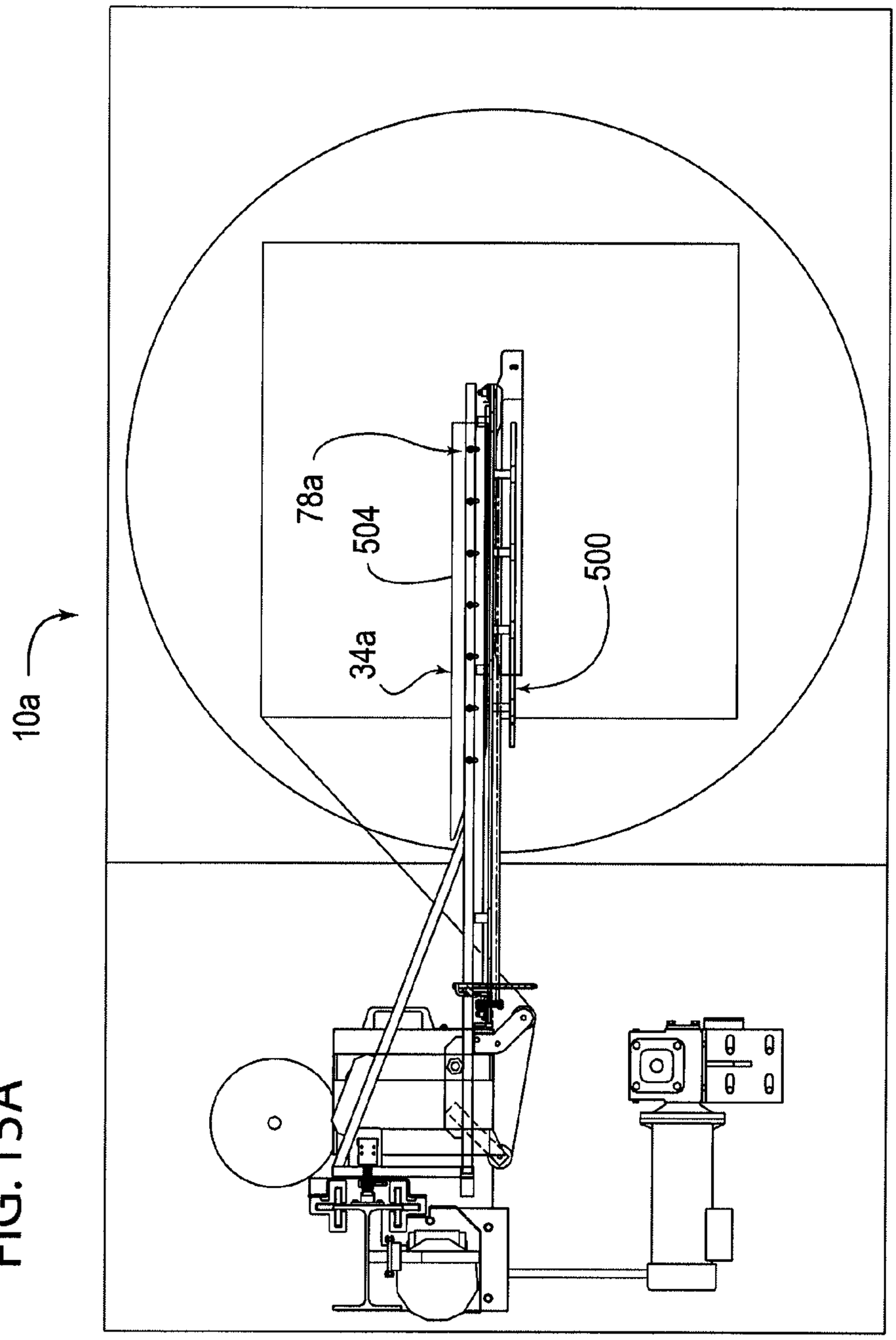


FIG. 15A

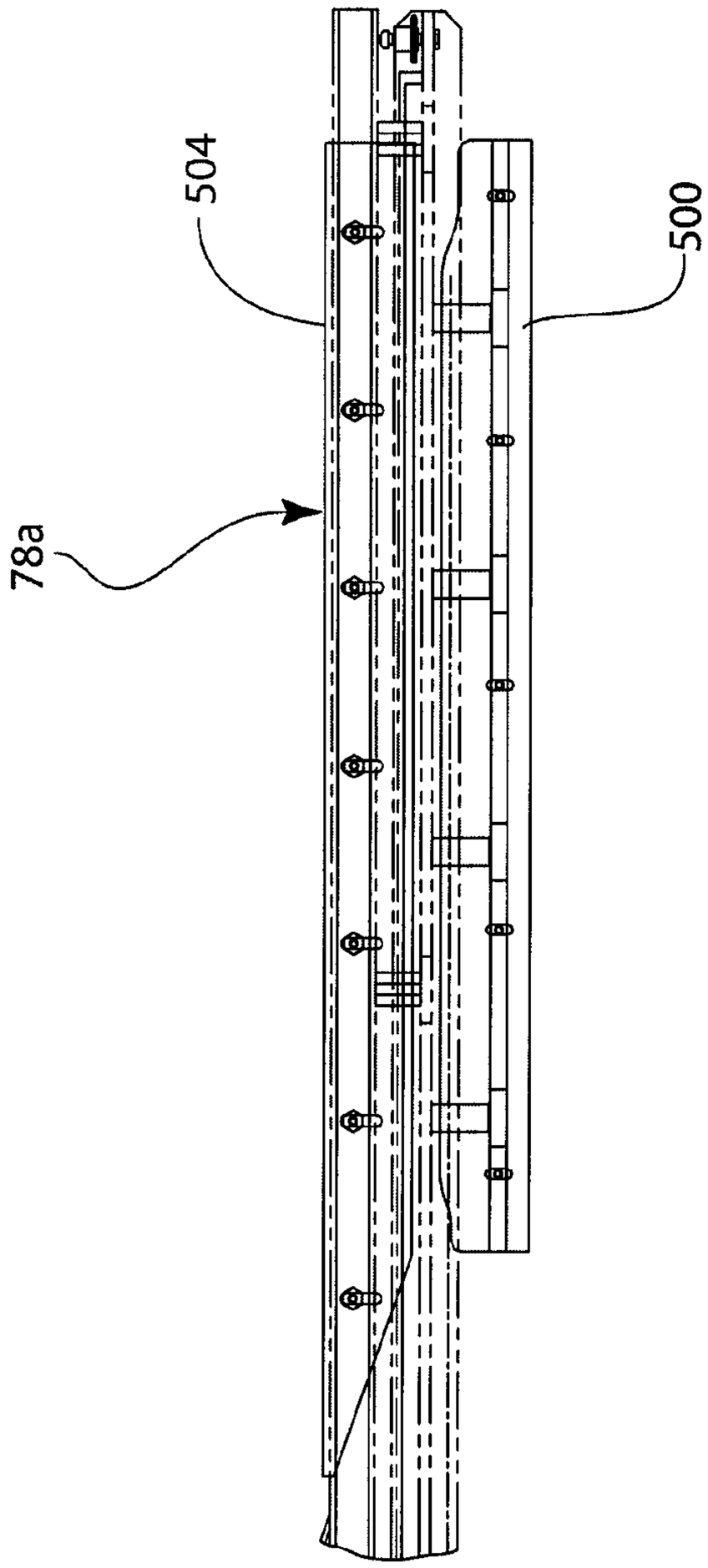


FIG. 15B

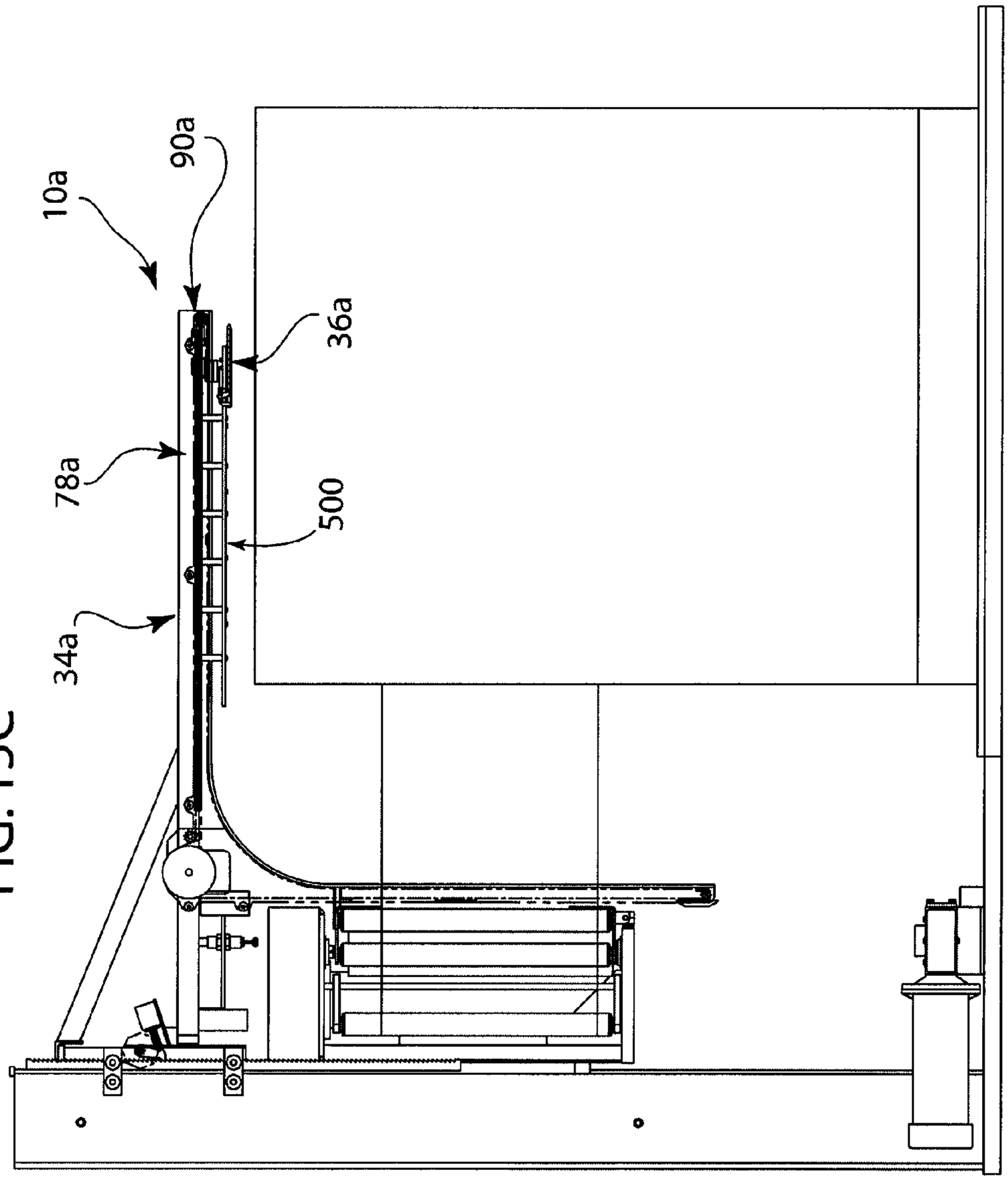


FIG. 15C

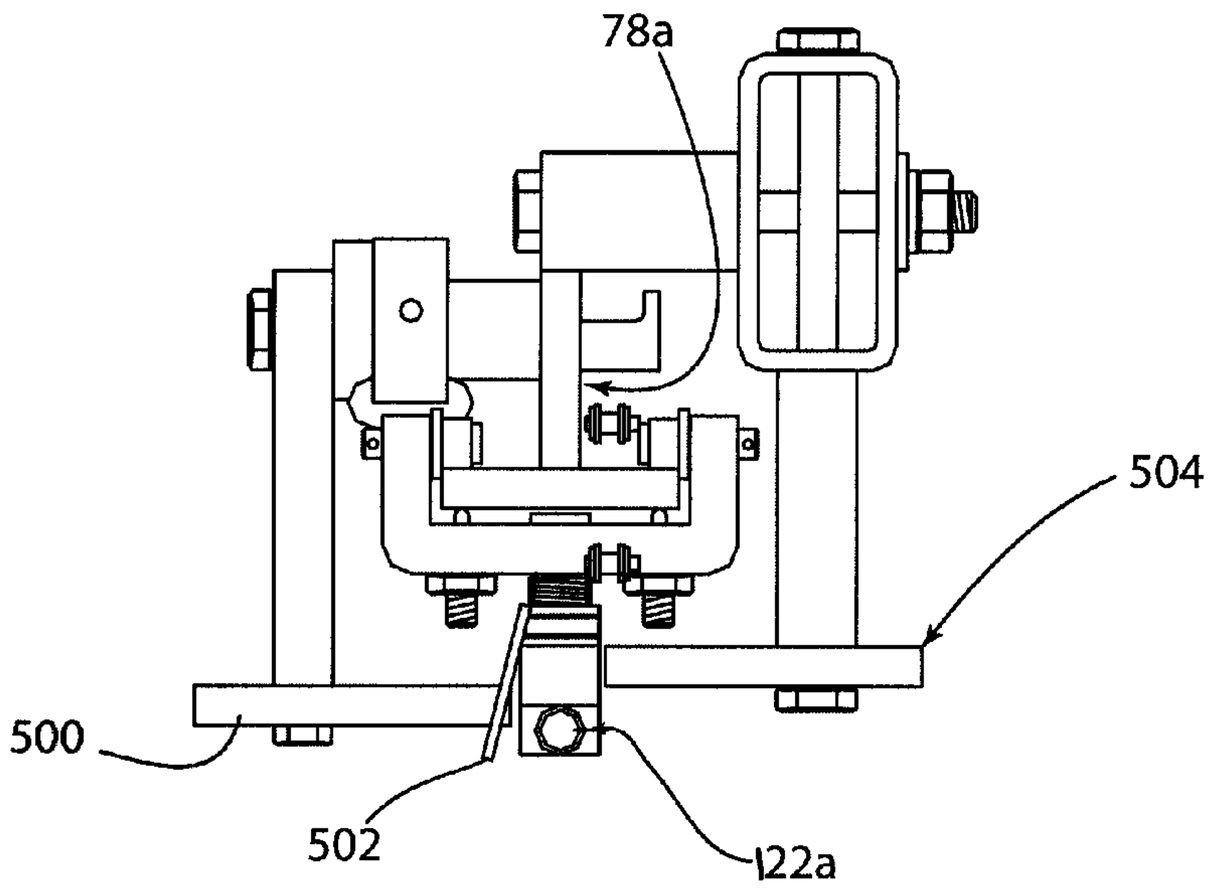


FIG. 15D

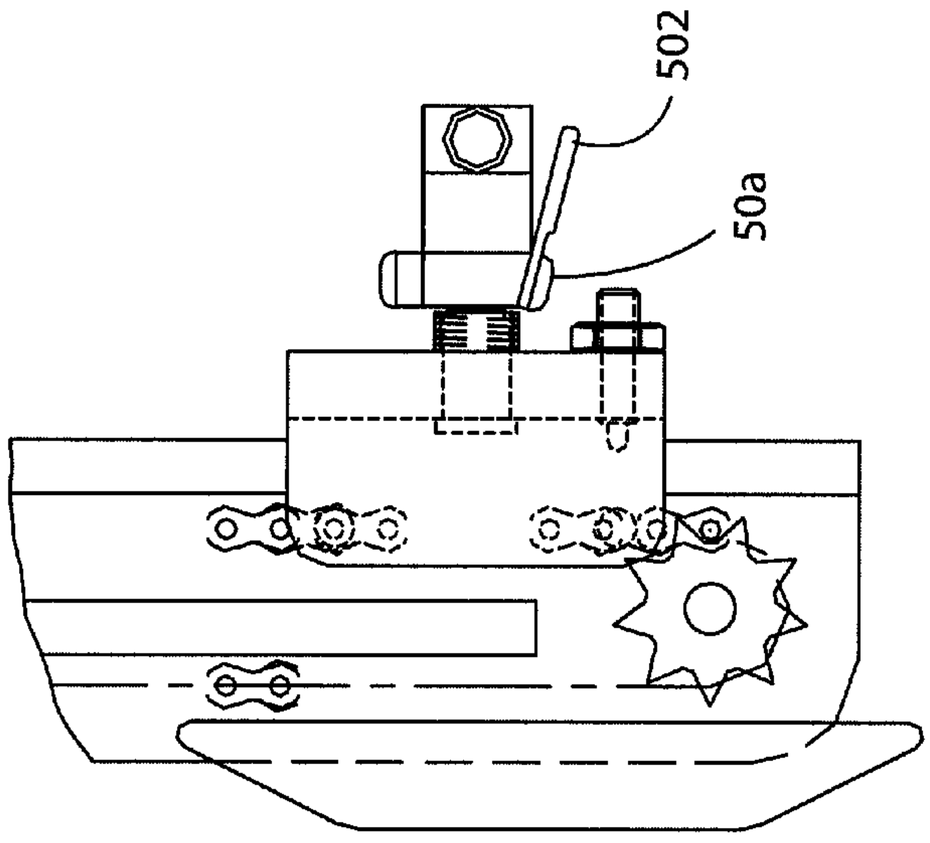


FIG. 16

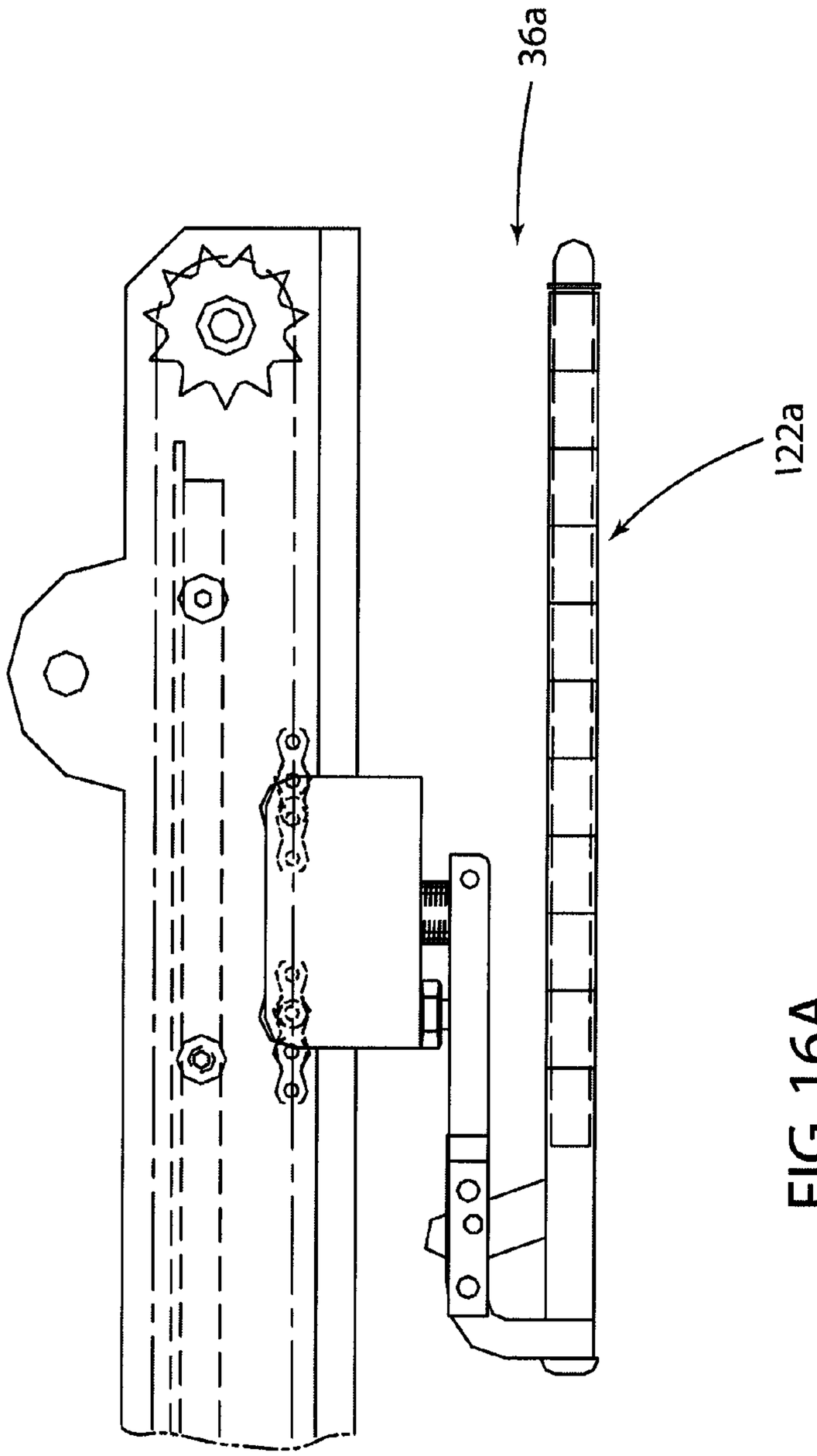
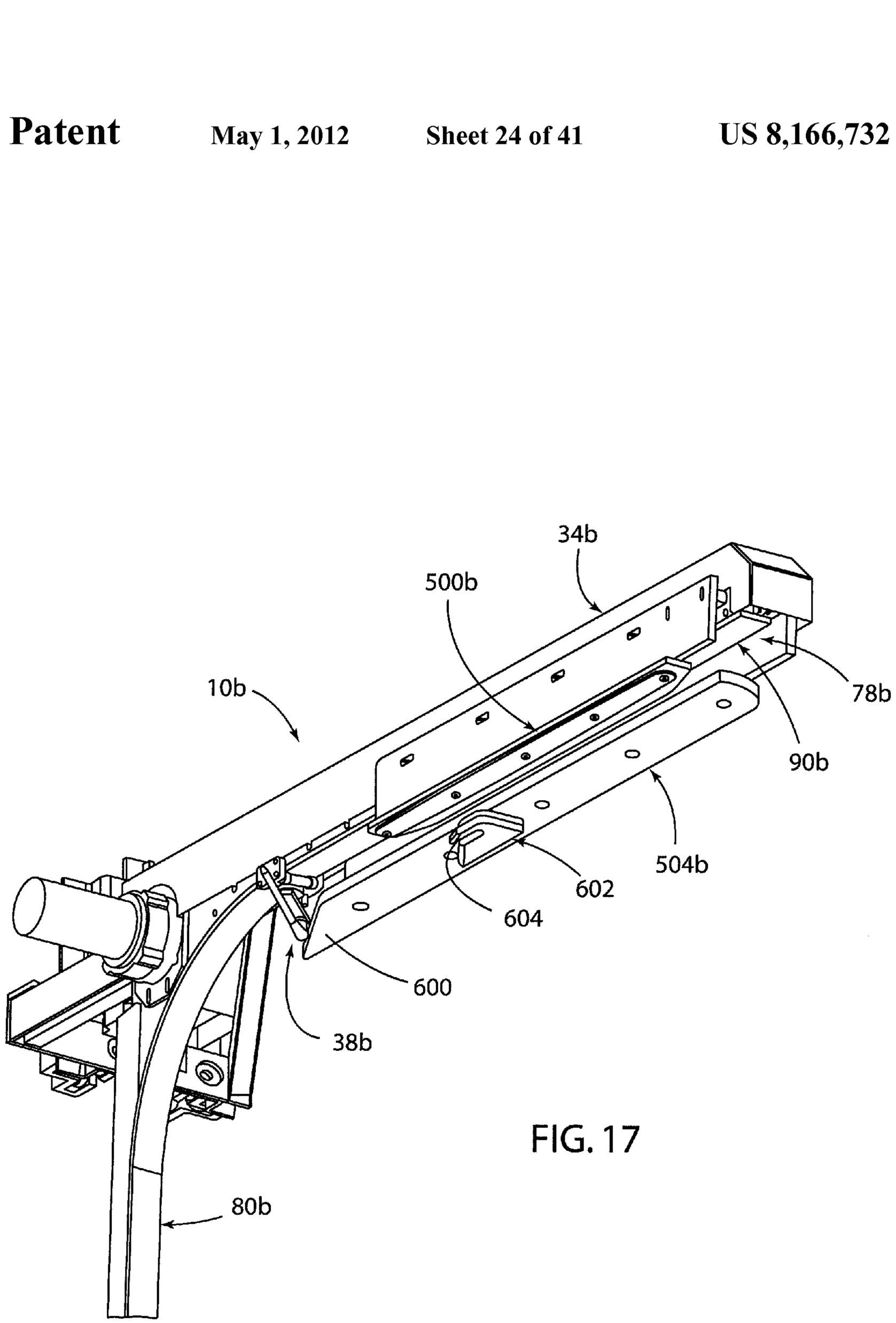


FIG. 16A



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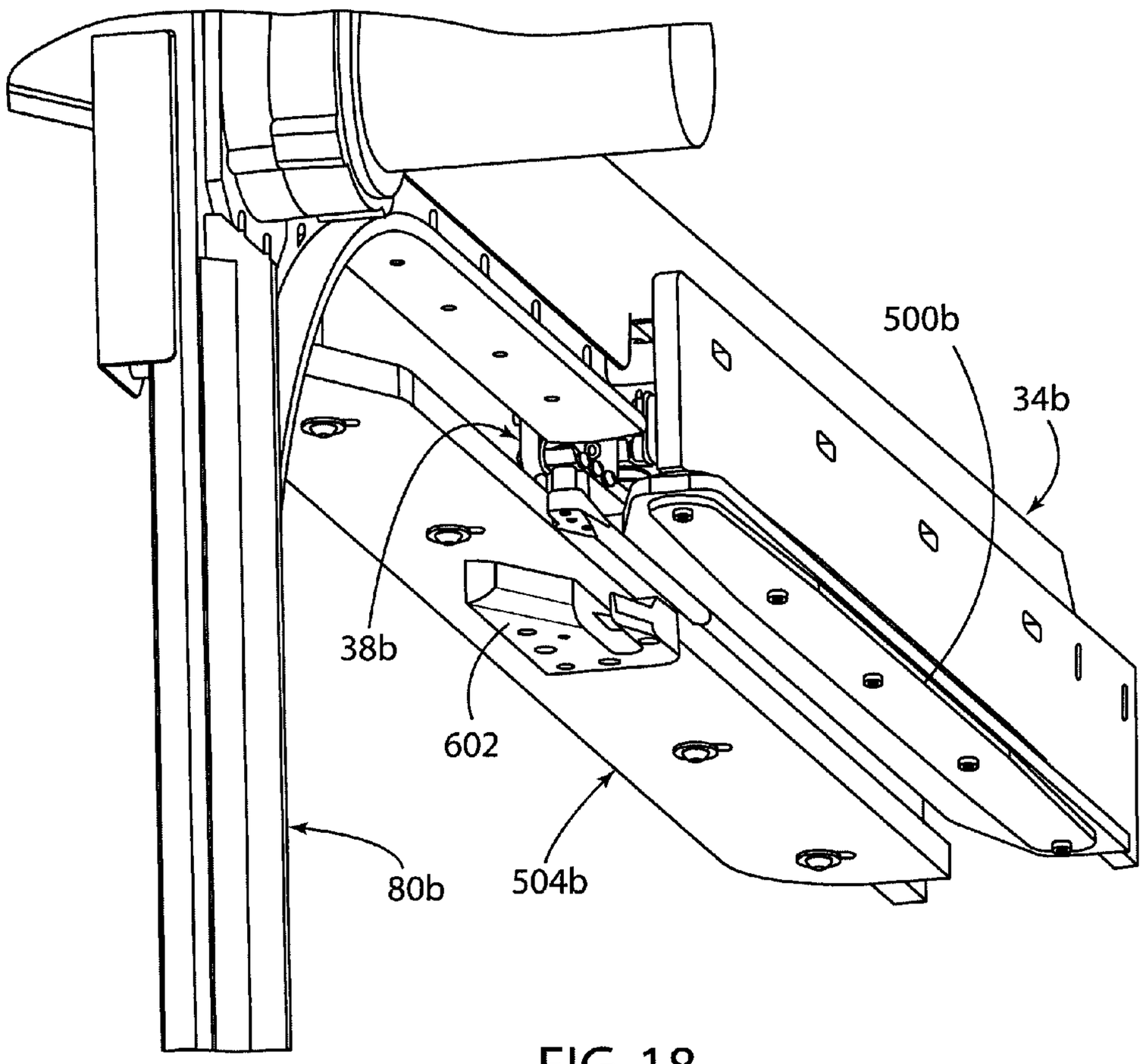

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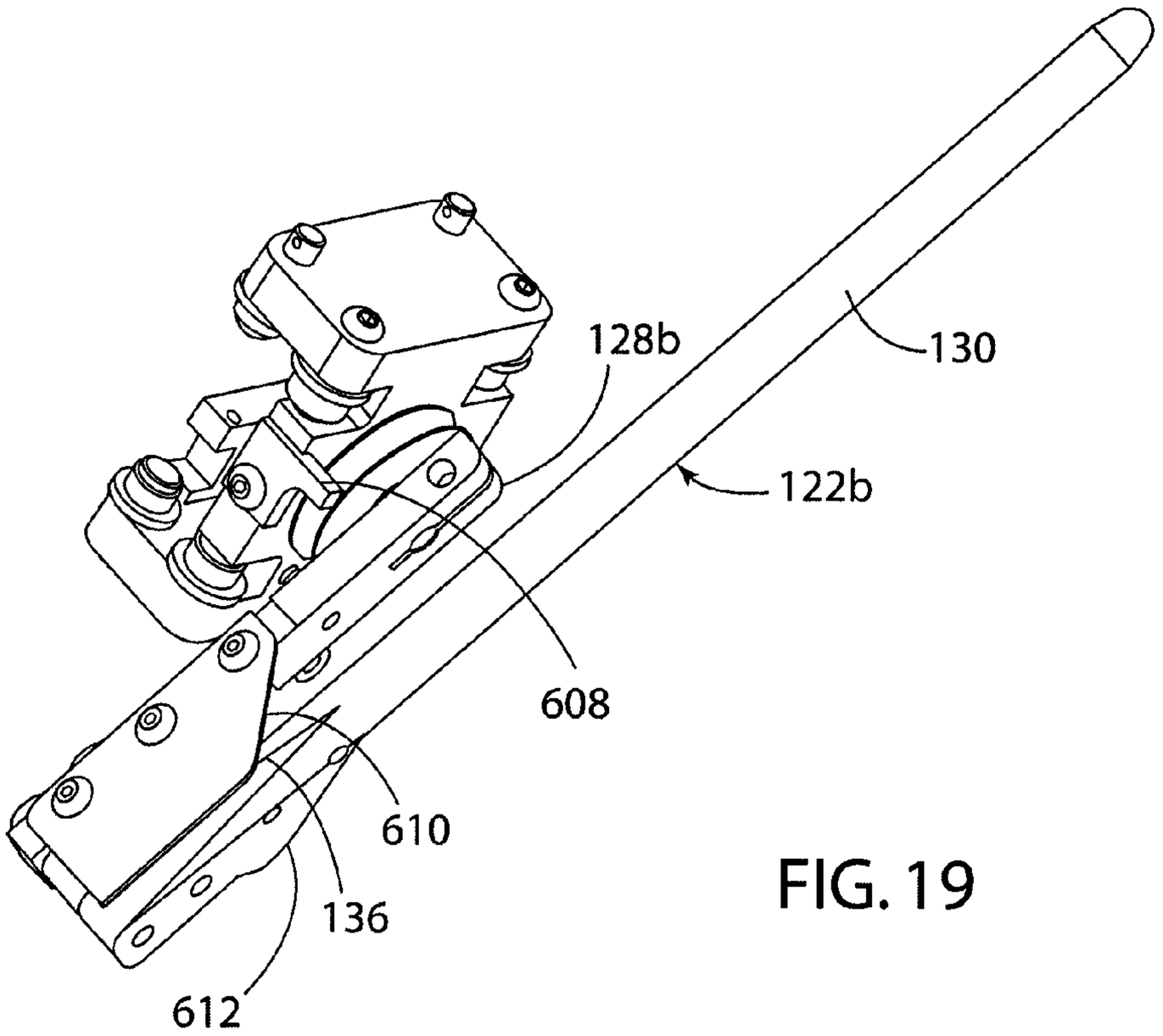


FIG. 19

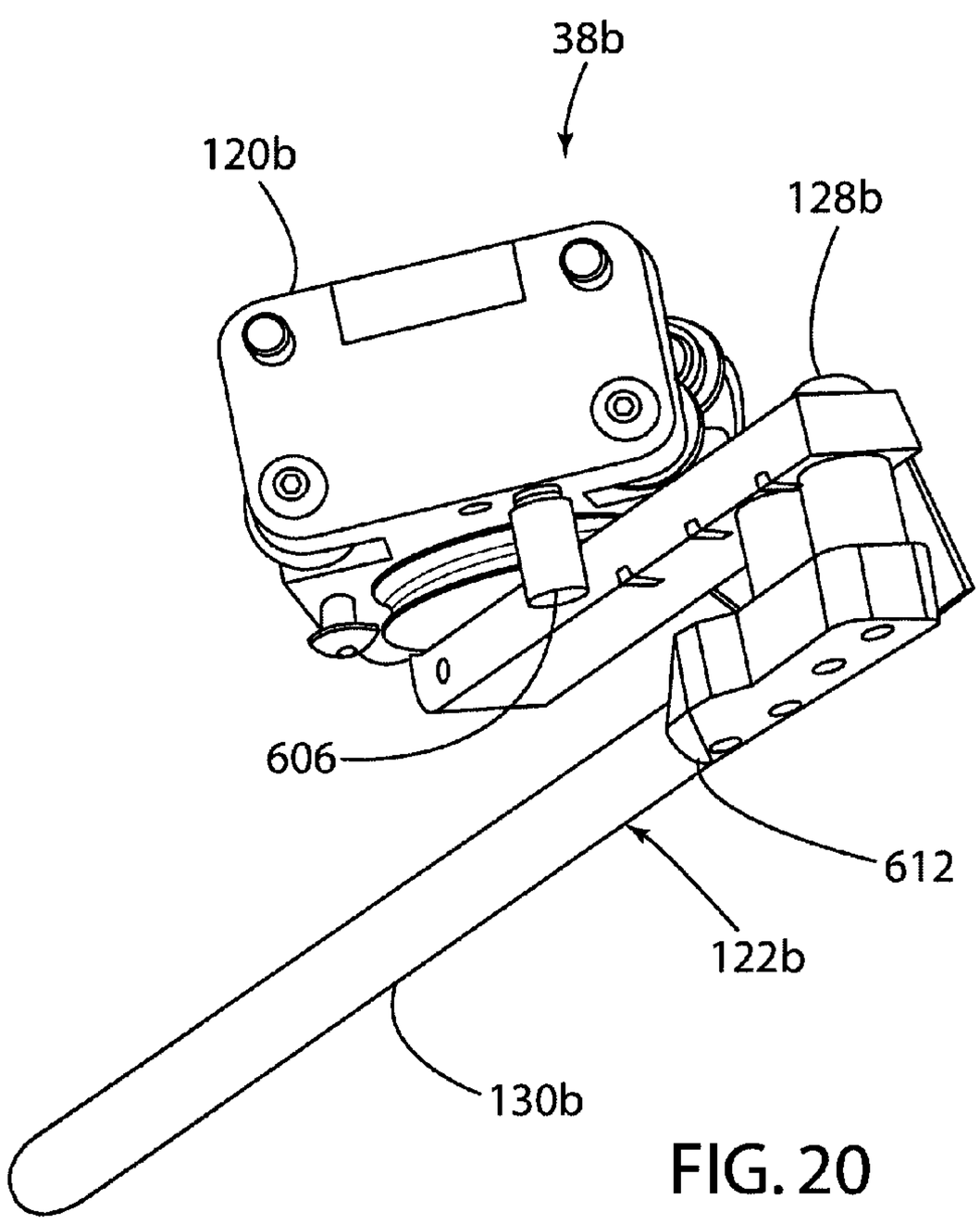


FIG. 20

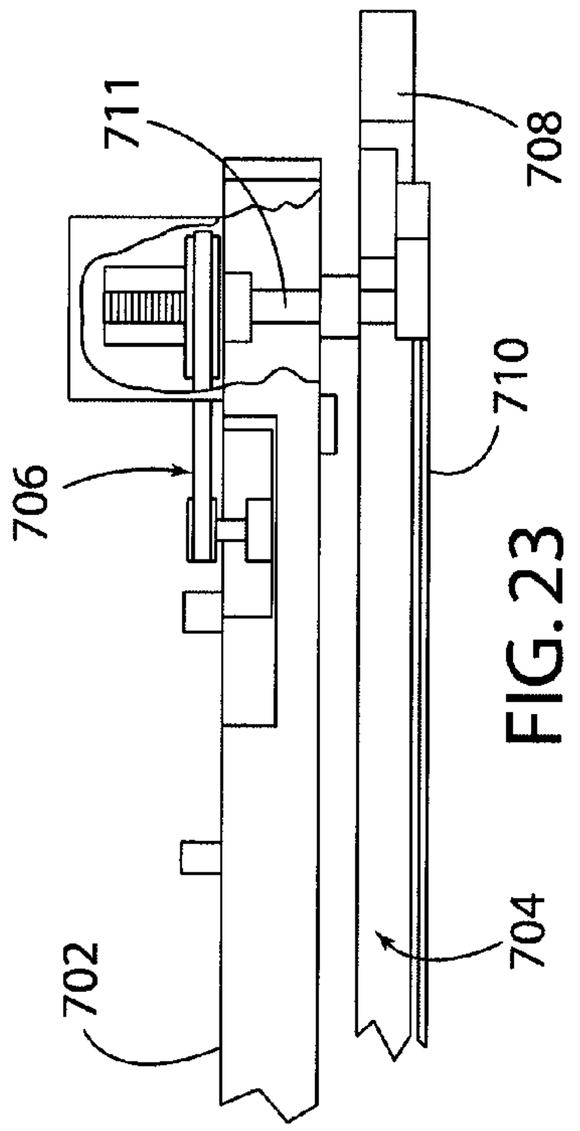
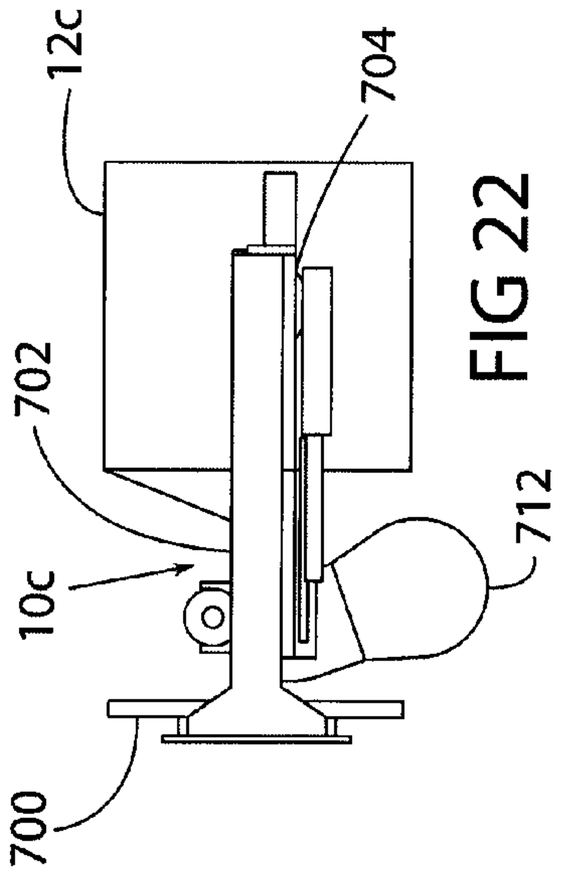


FIG. 23



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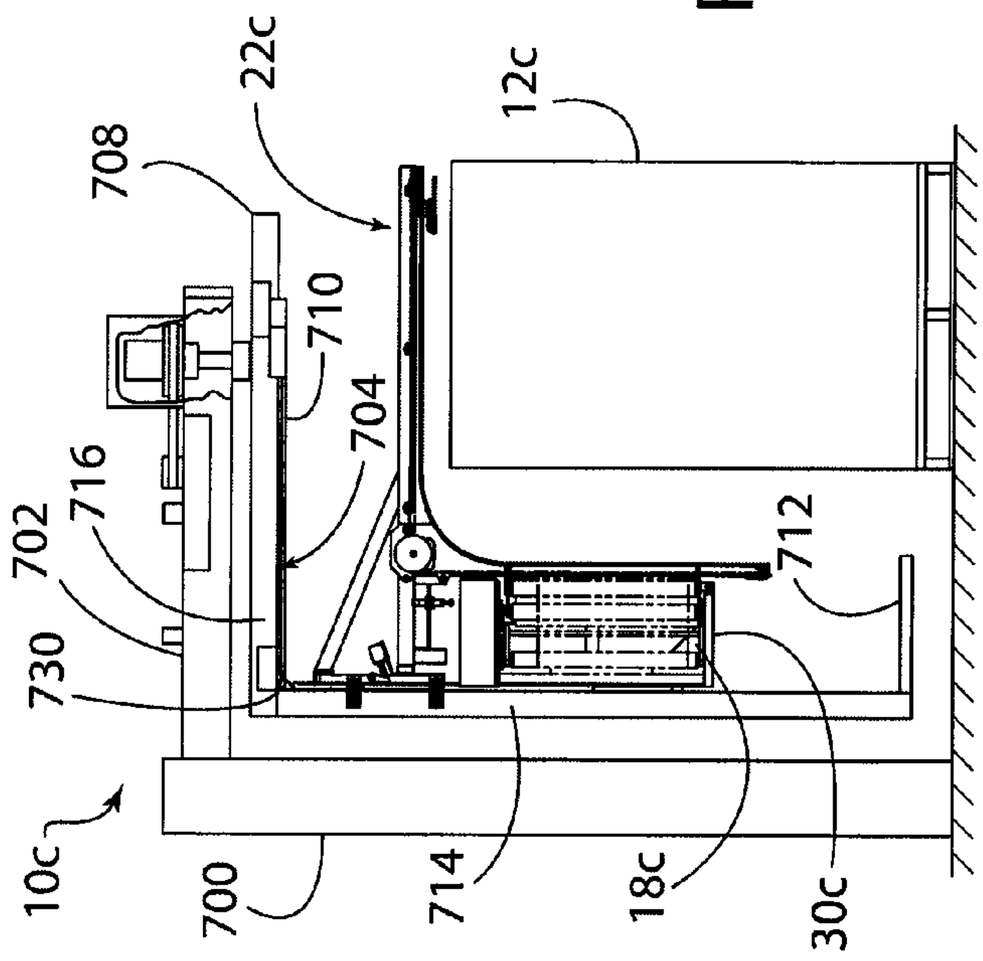

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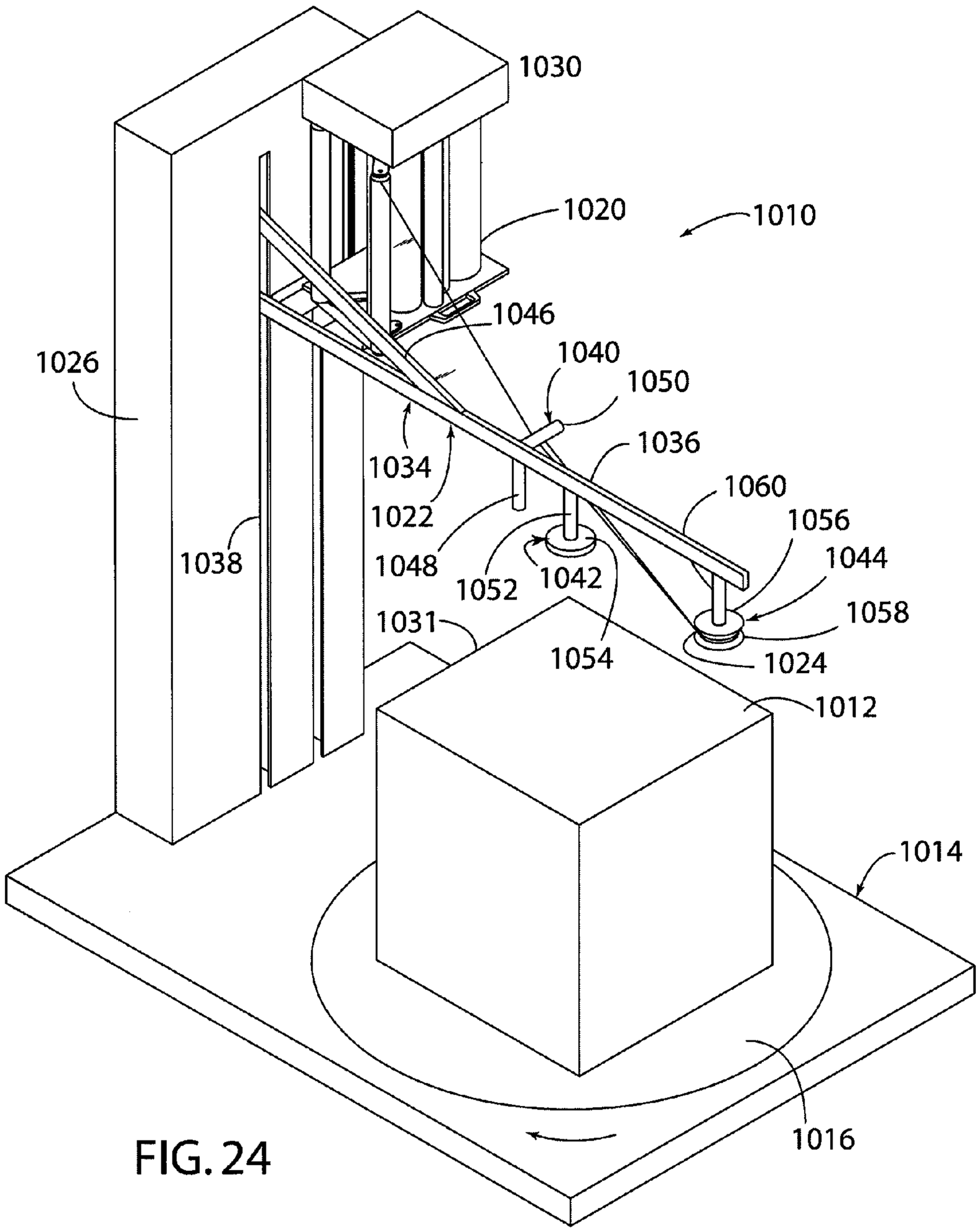
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FIG. 24

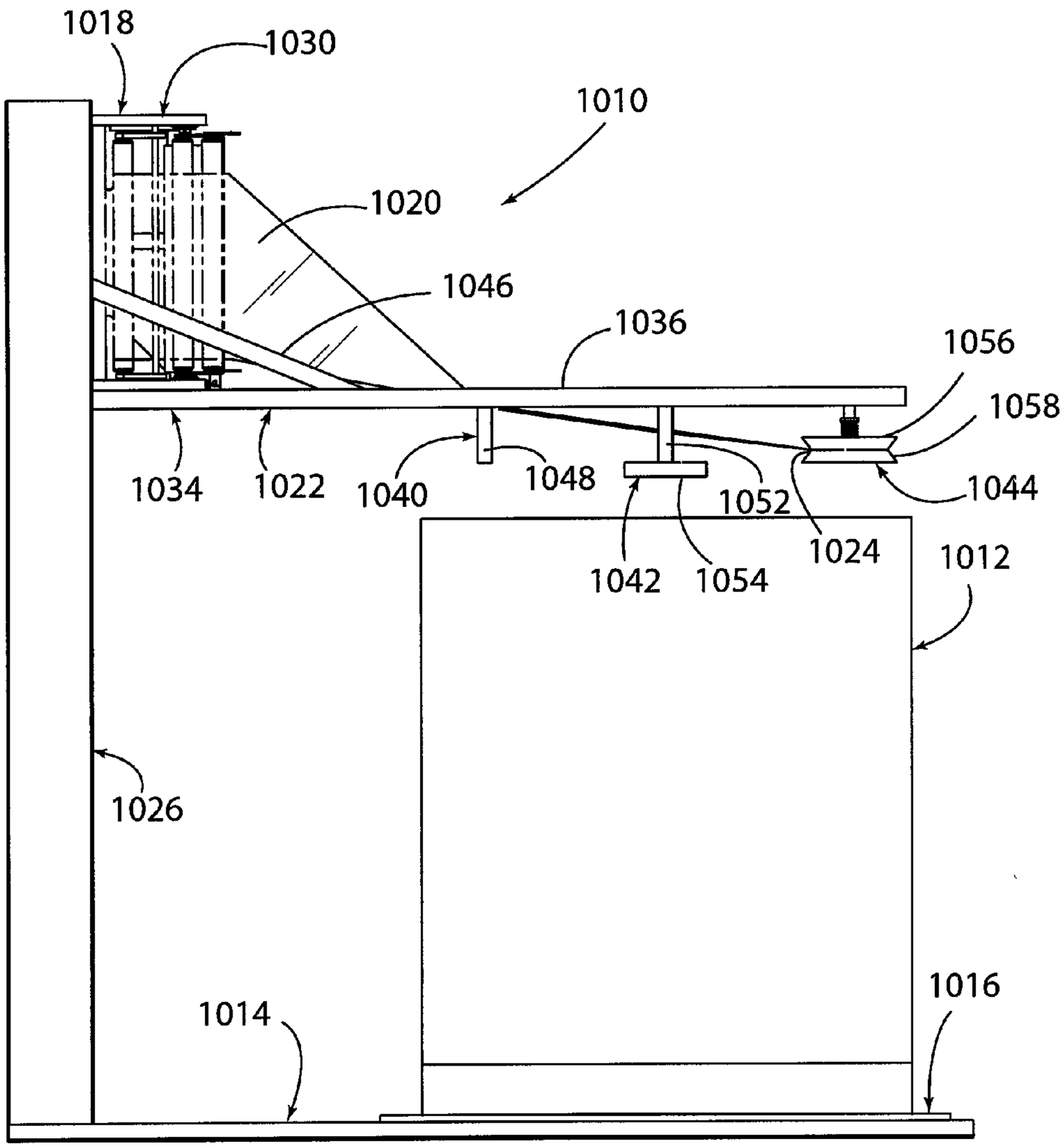
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FIG. 25

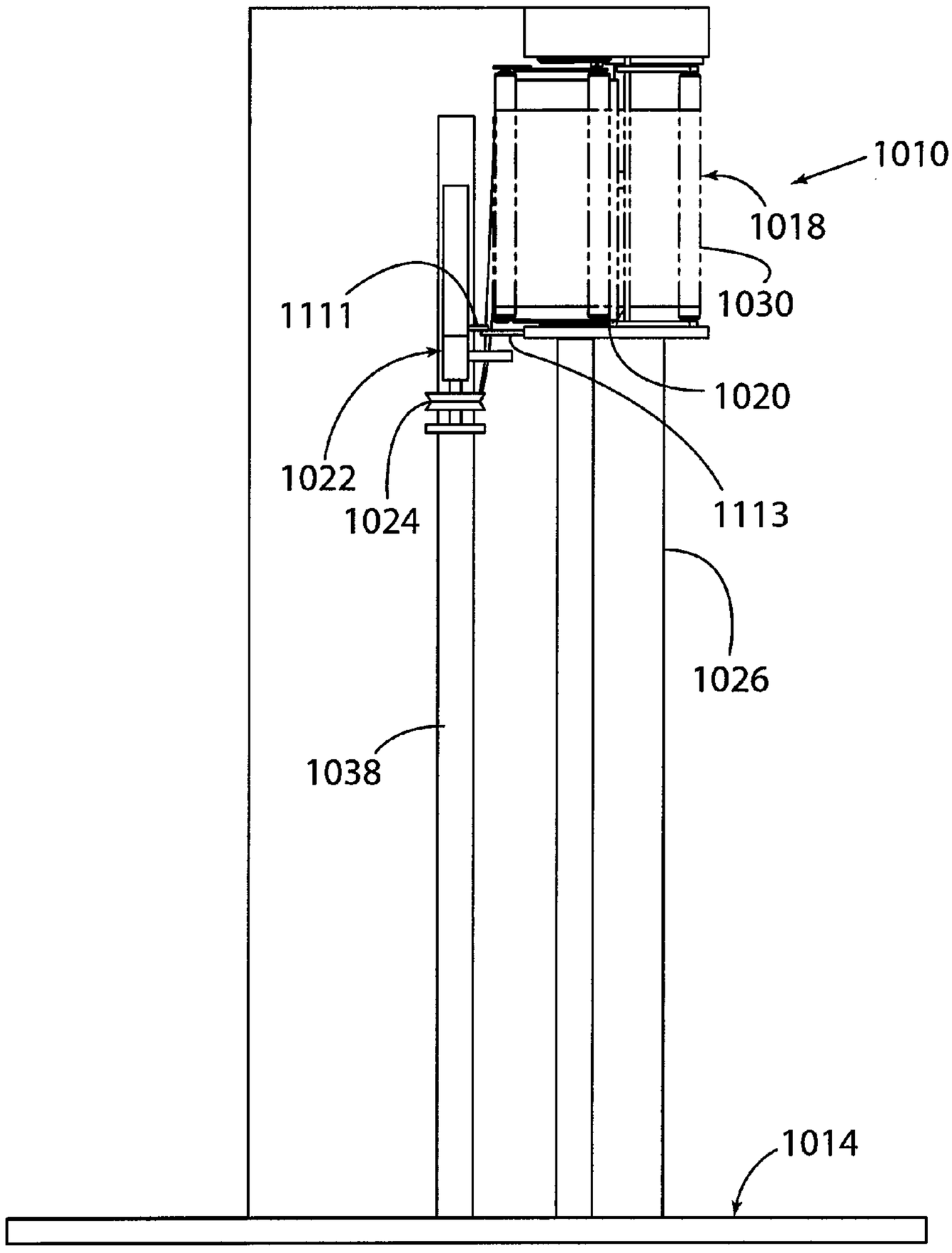

FIG. 26

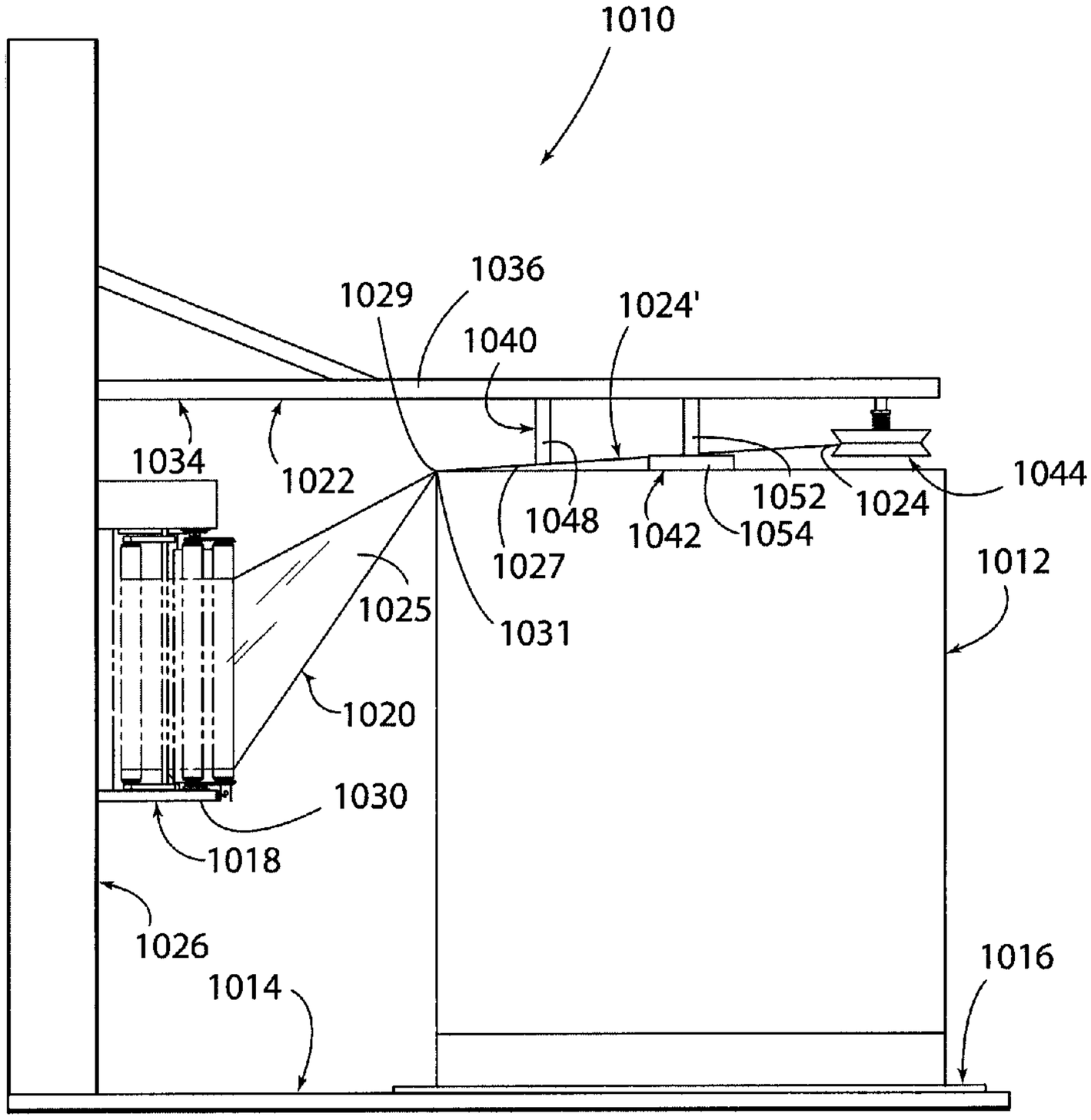
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FIG. 27

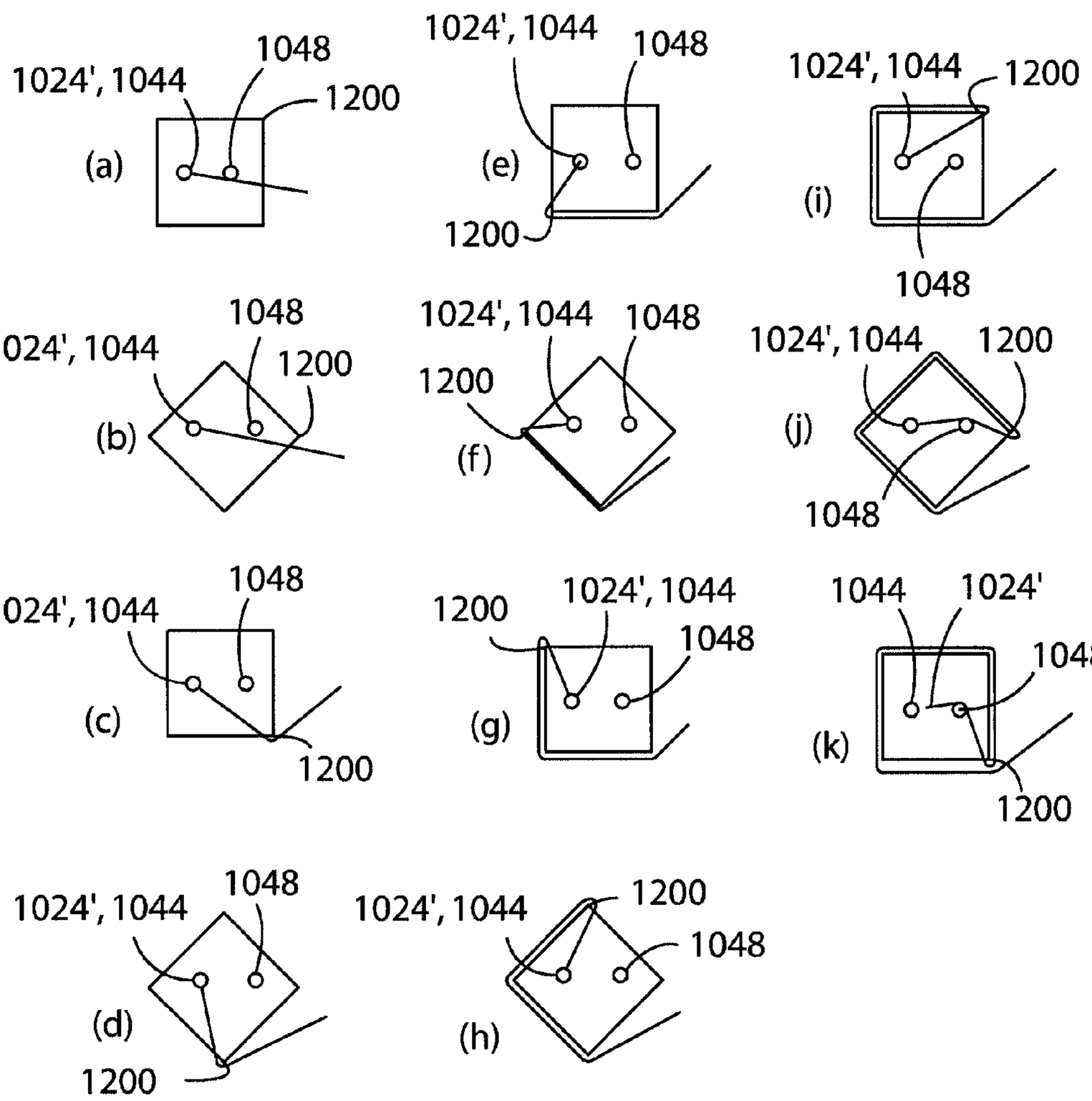
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FIG. 28

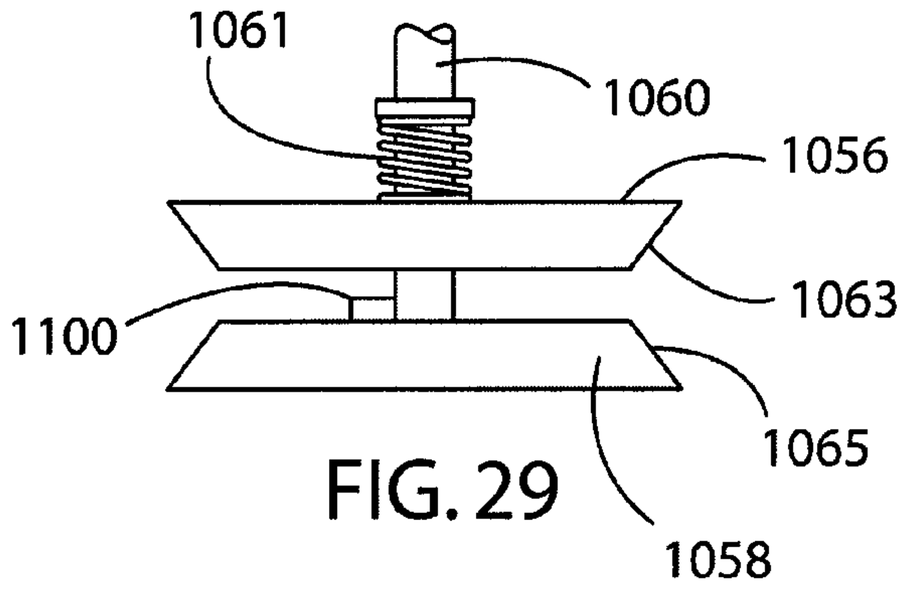

FIG. 29

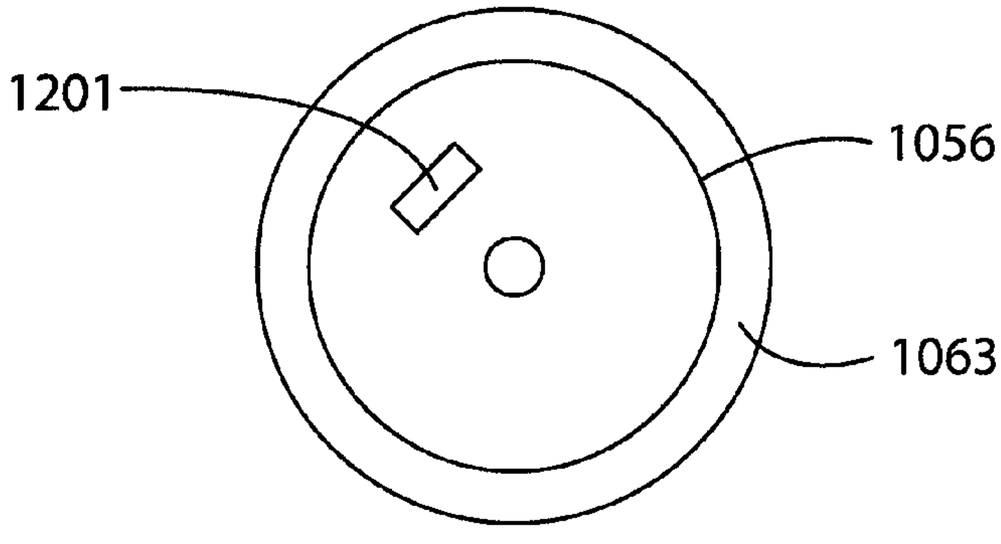

FIG. 30

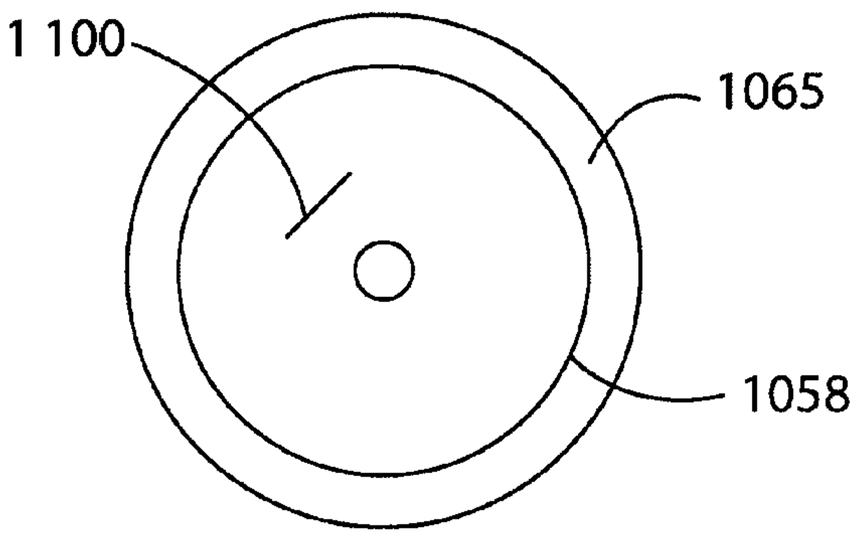

FIG. 31

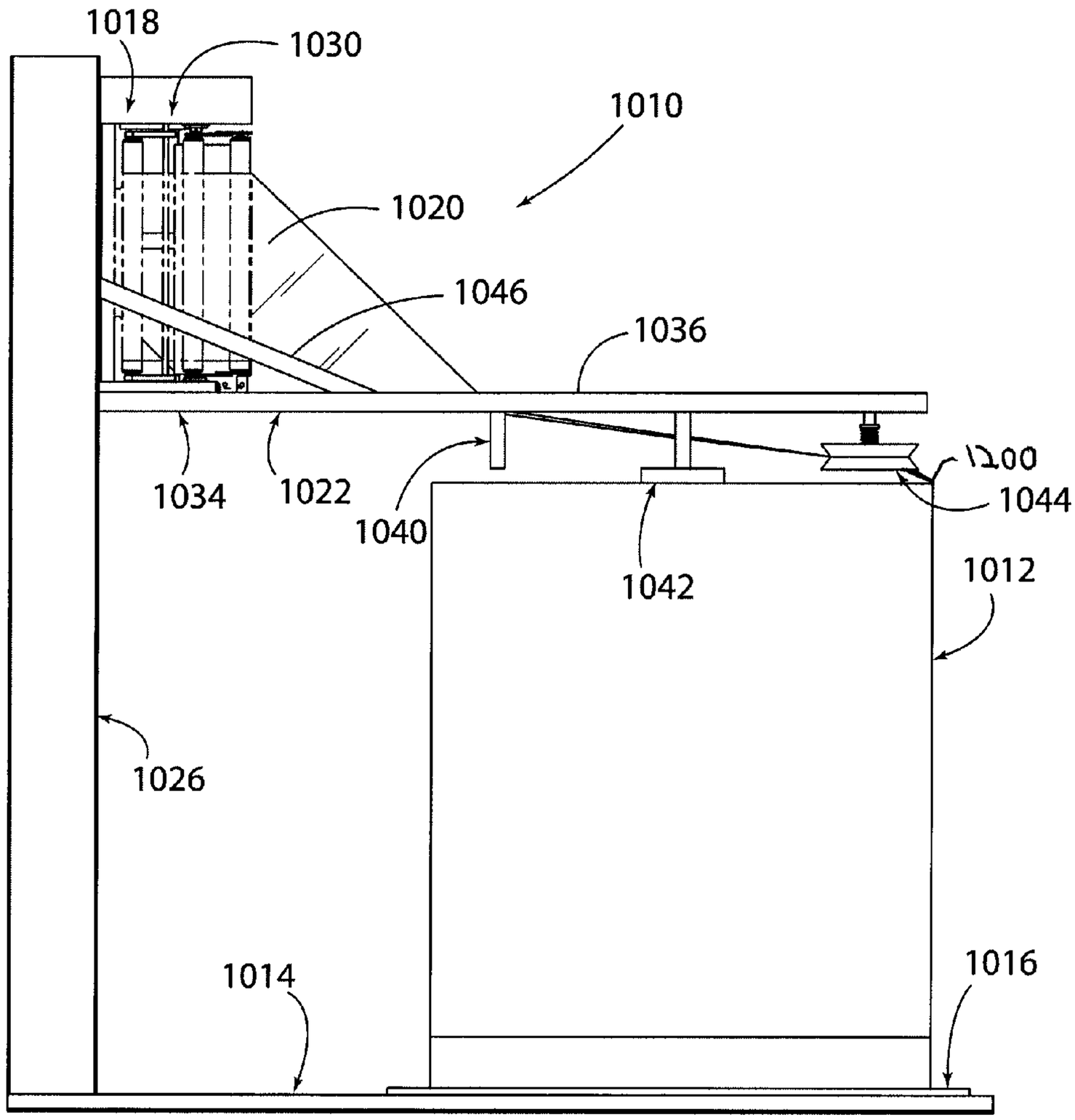
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FIG. 32

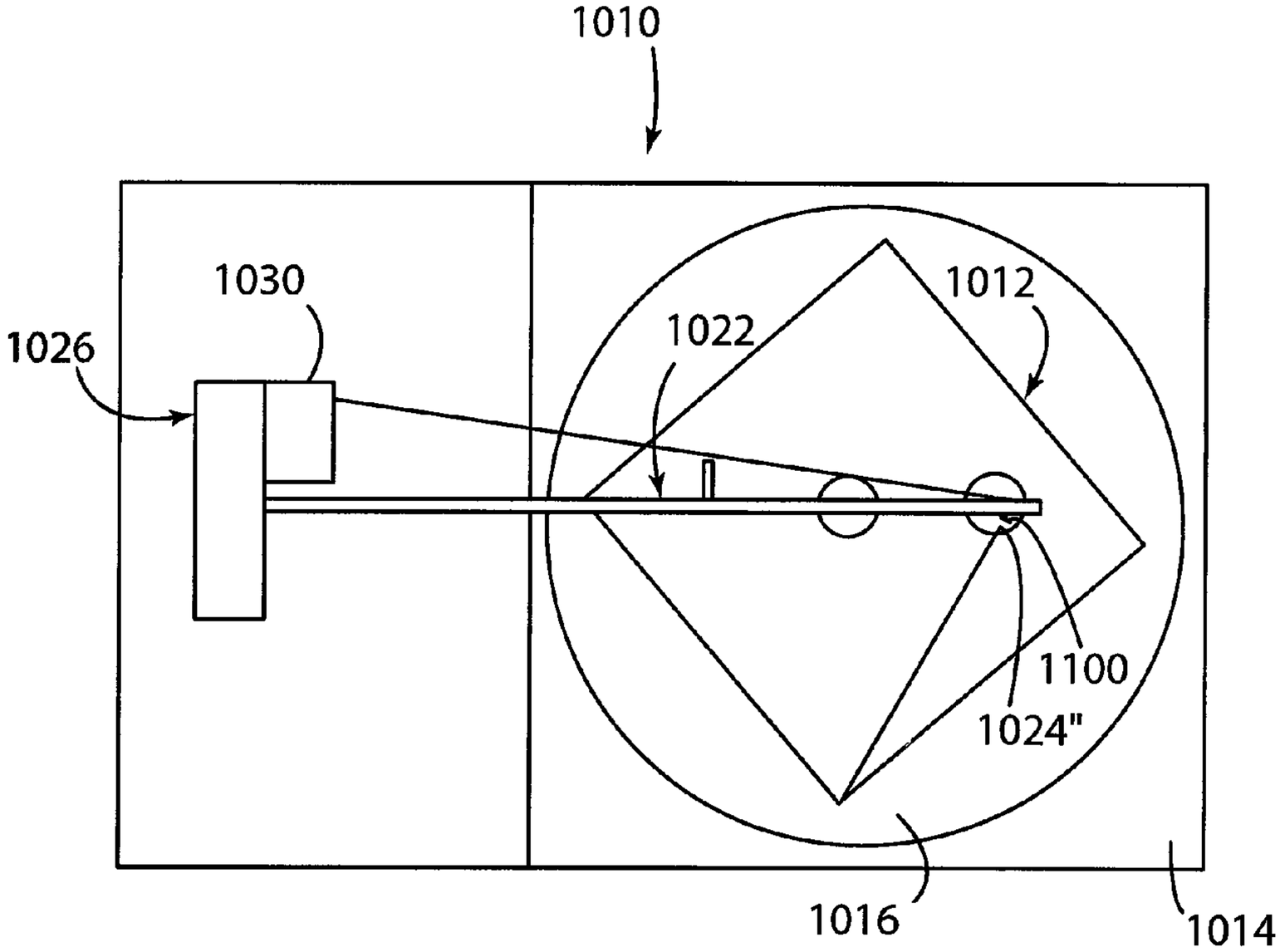


FIG. 33

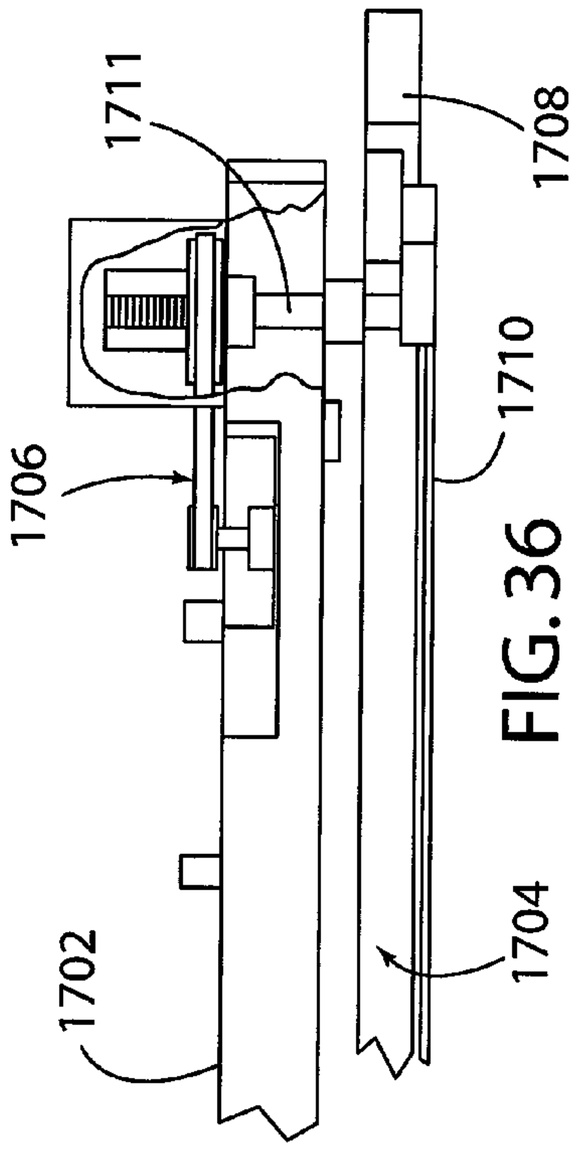


FIG. 36

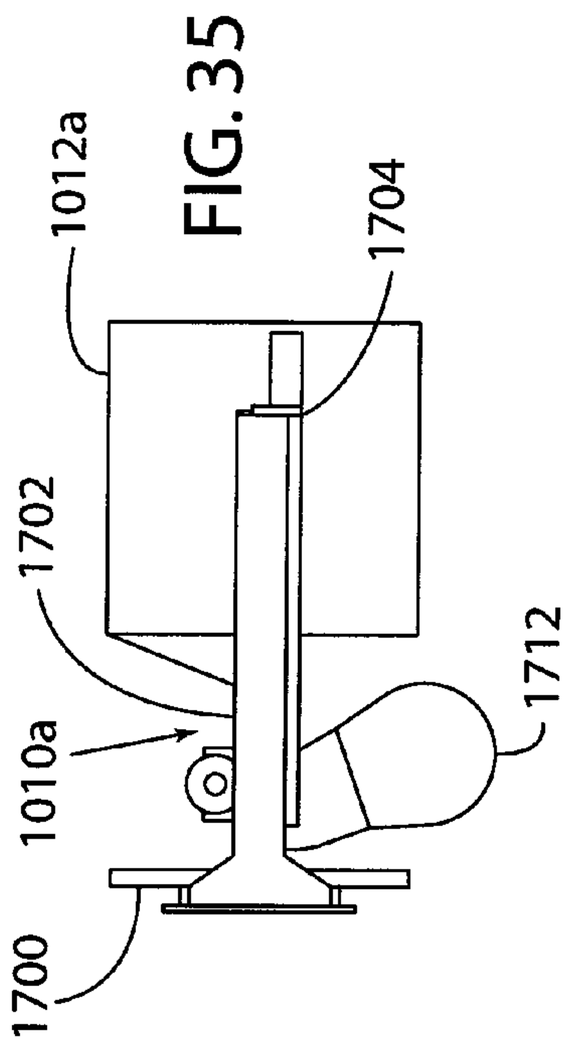


FIG. 35

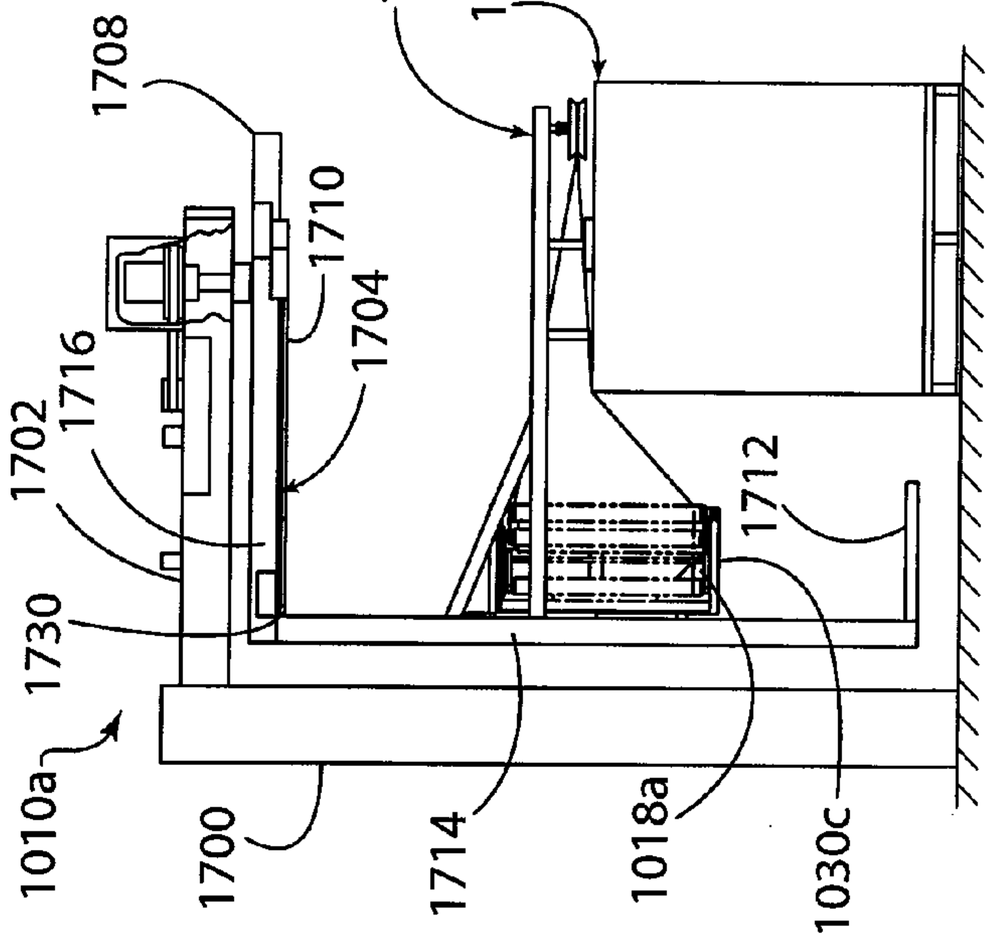
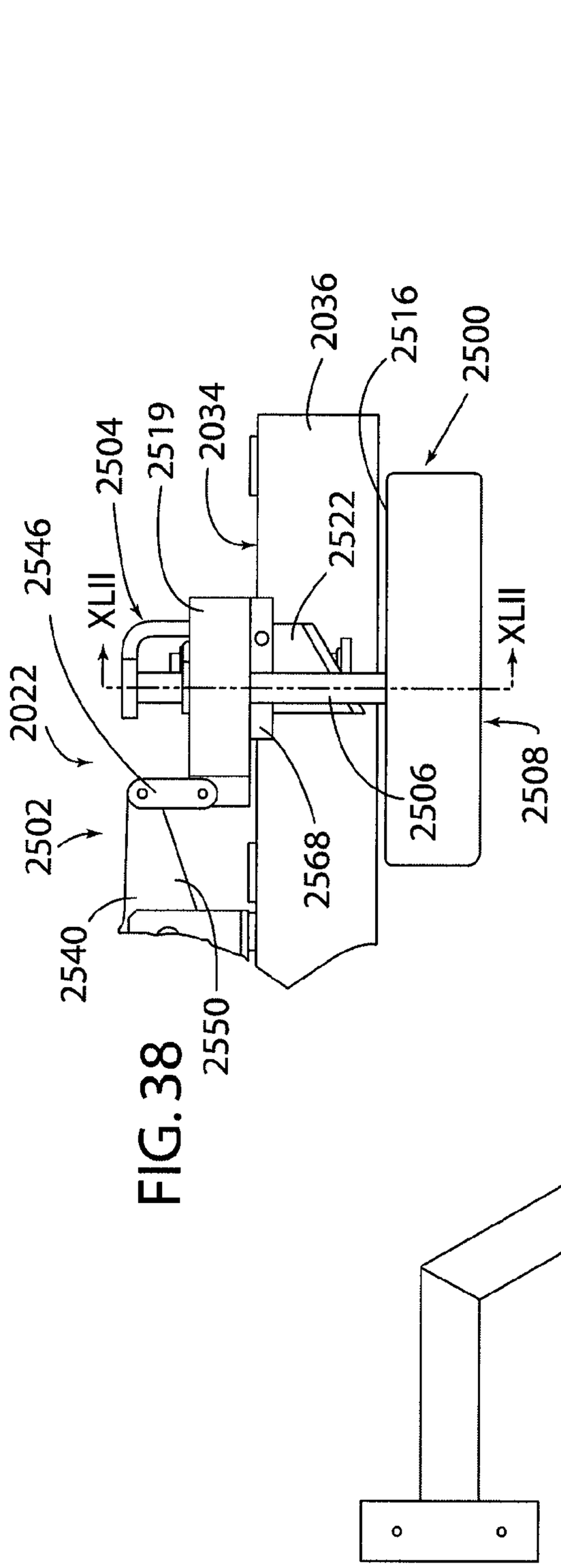


FIG 34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2519
2034
2036
2516
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2546
XLII
2522
2022
2502
2506
XLII
2540
2568
2508
2550

FIG. 38

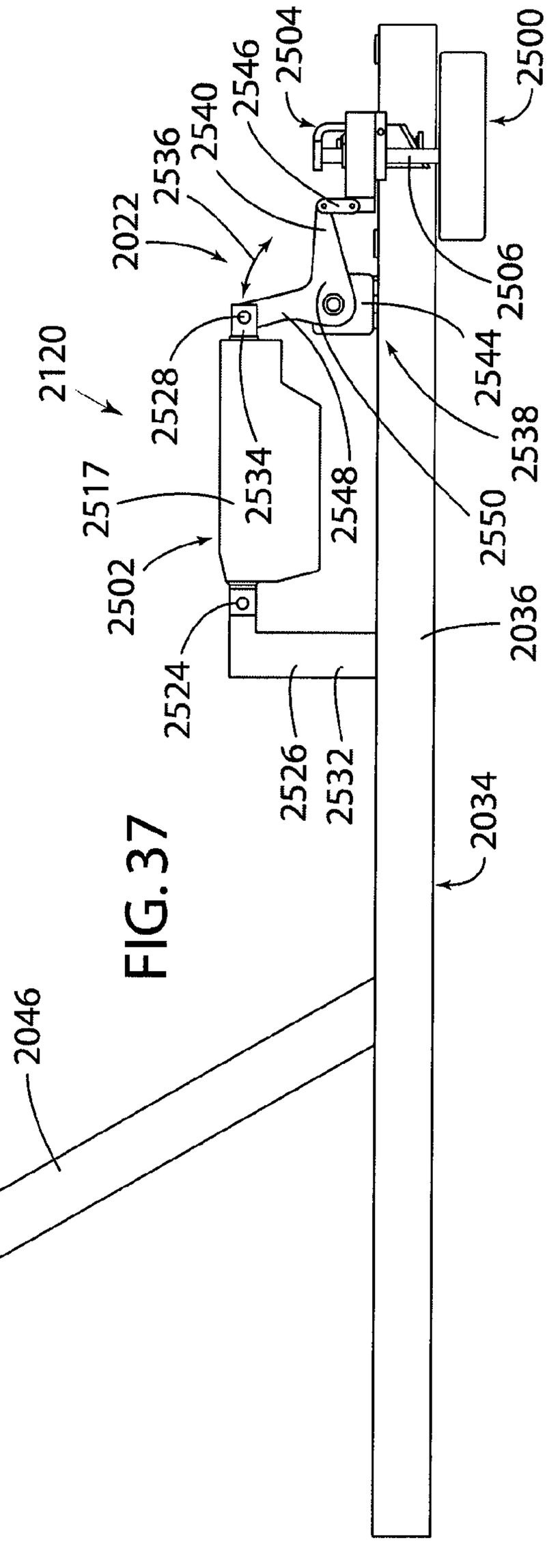
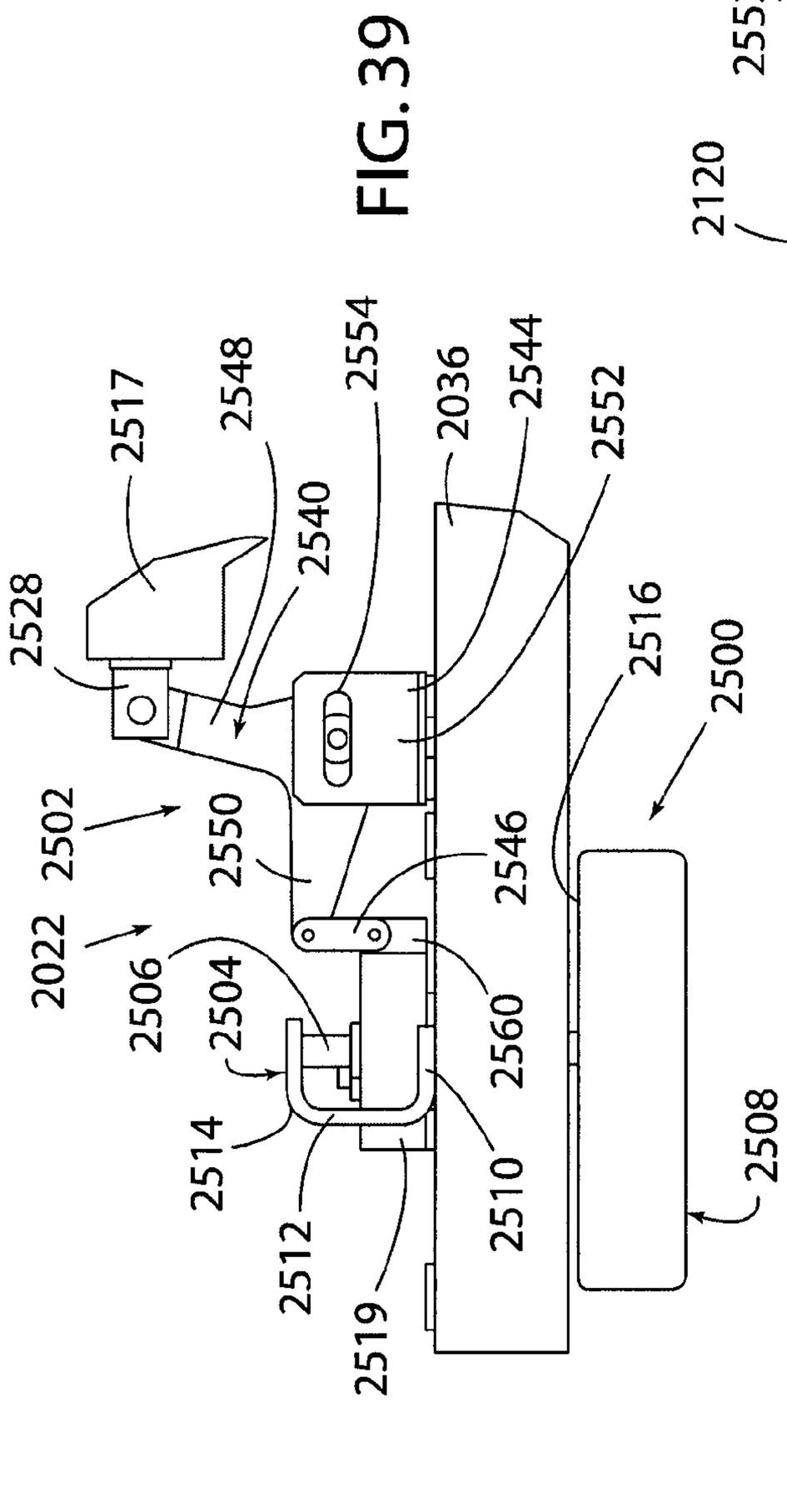

2504
2546
2540
2536
2022
2500
2506
2120
2528
2544
2538
2517
2534
2548
2550
2502
2036
2524
2526
2532
2034
2046

FIG. 37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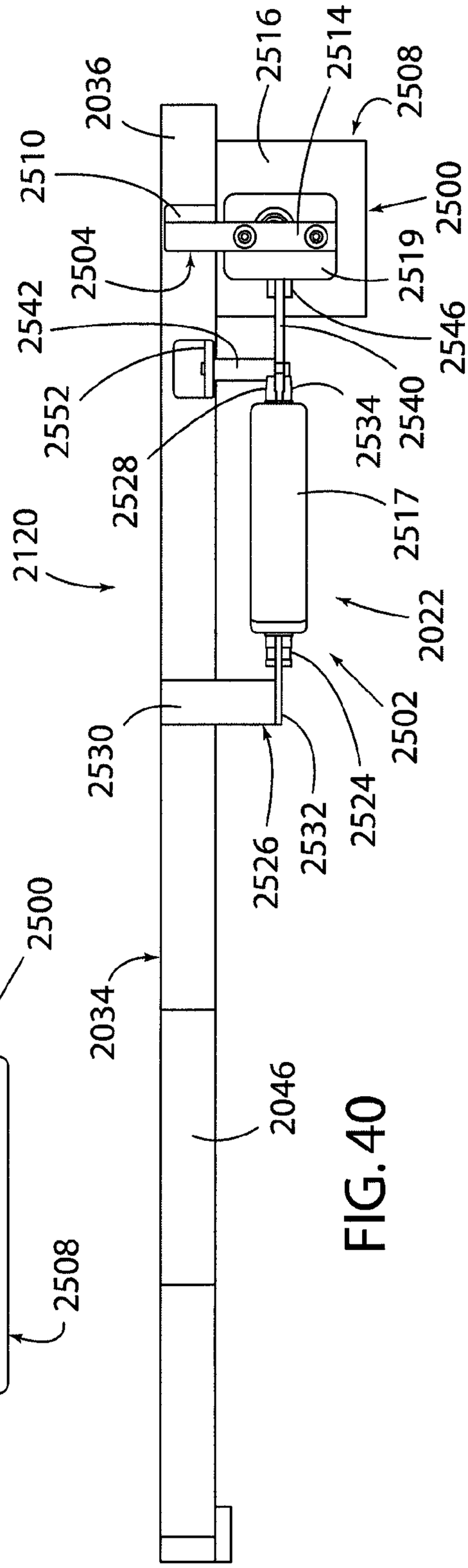
2514
2512
2519
2510
2508

FIG. 39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2510
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2546
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2540
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2517
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2022
2502
2530
2524
2532
2526
2034
2046

FIG. 40

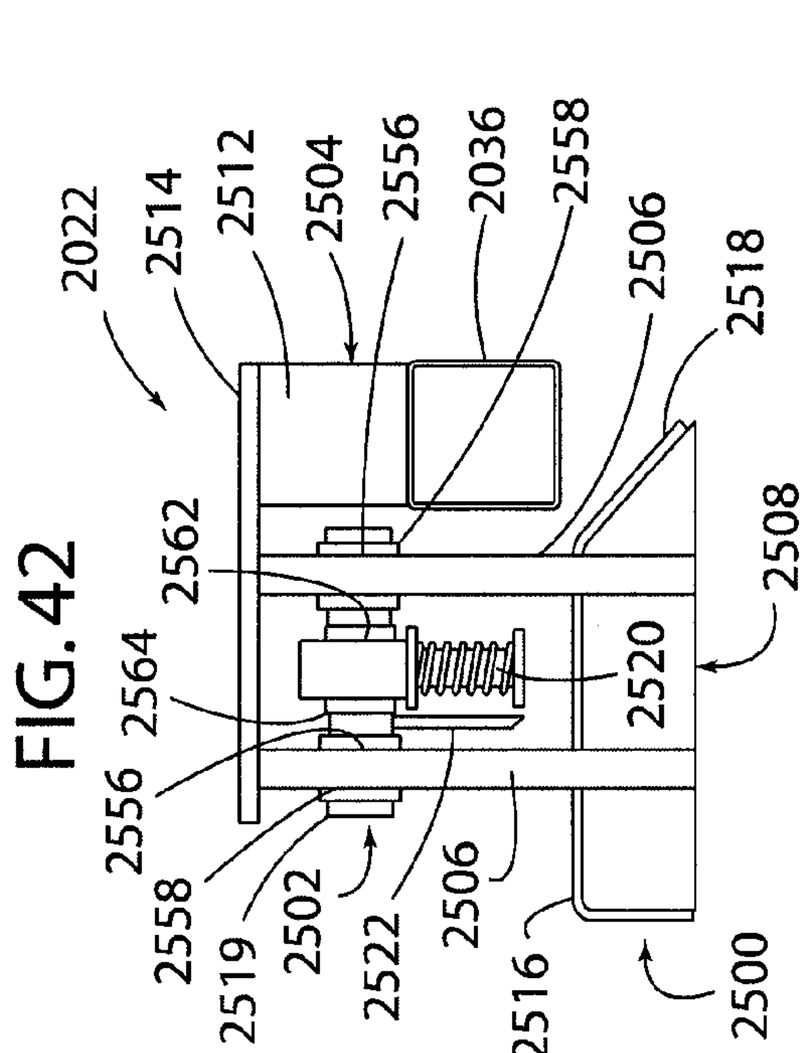


FIG. 42

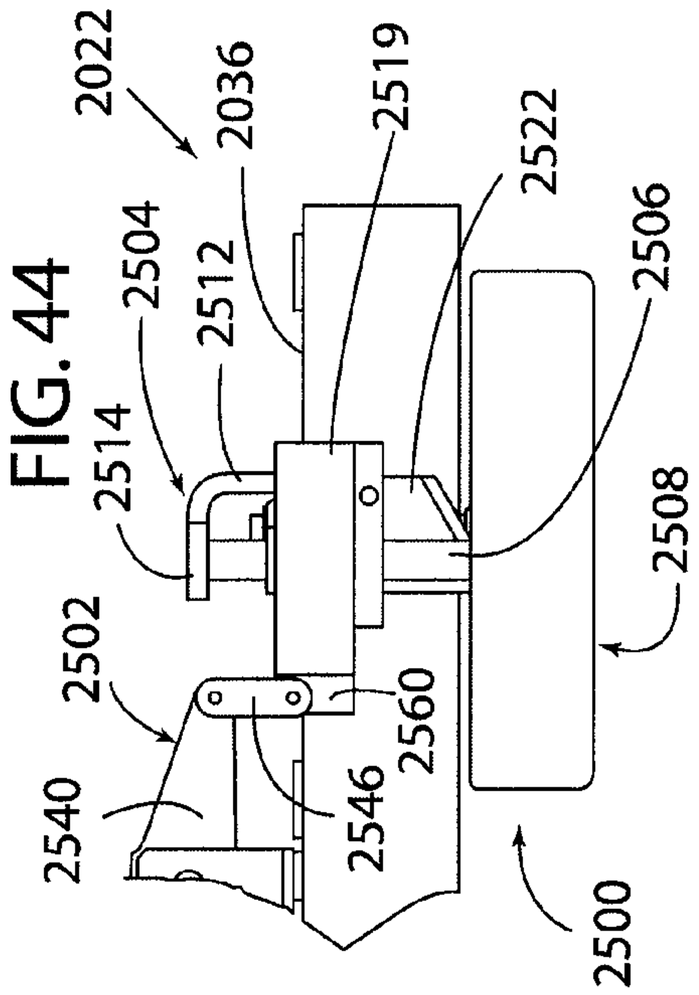


FIG. 44

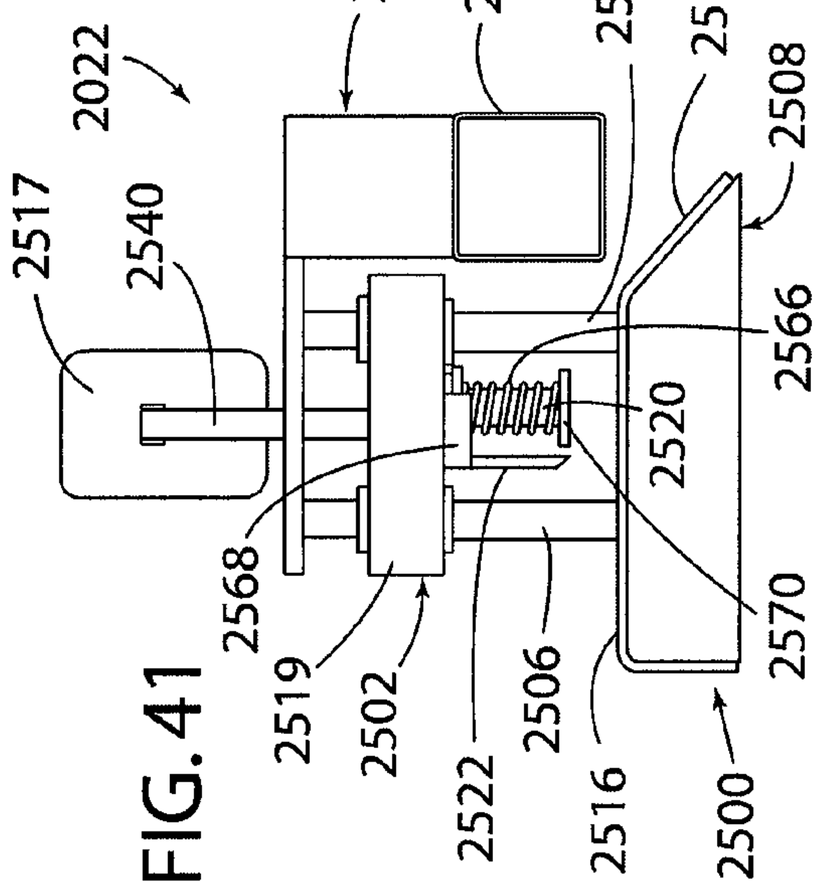


FIG. 41

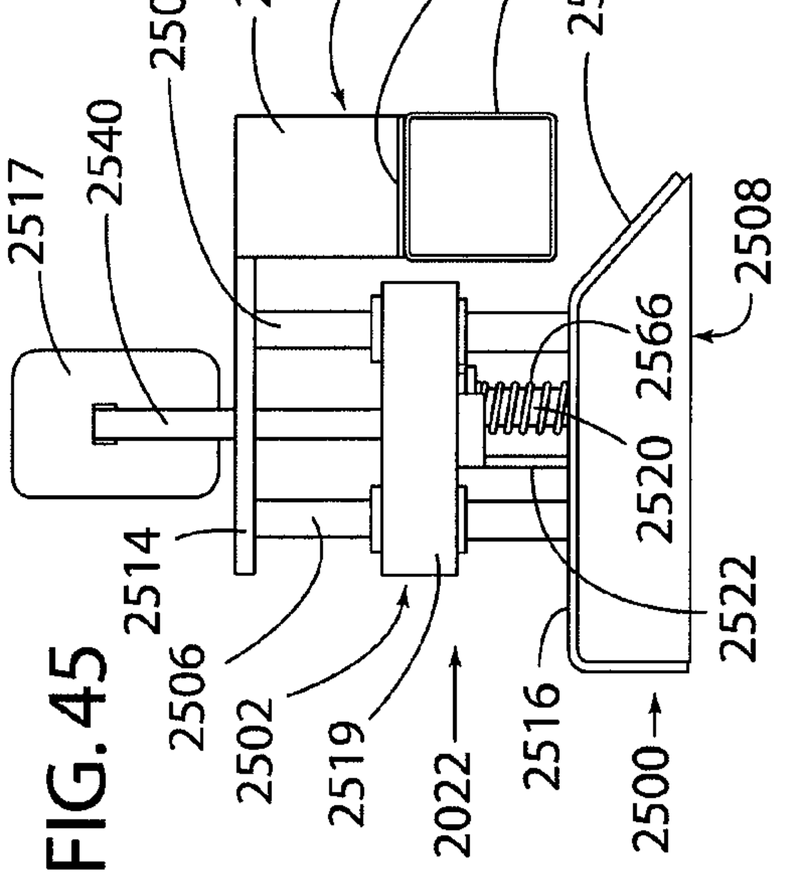
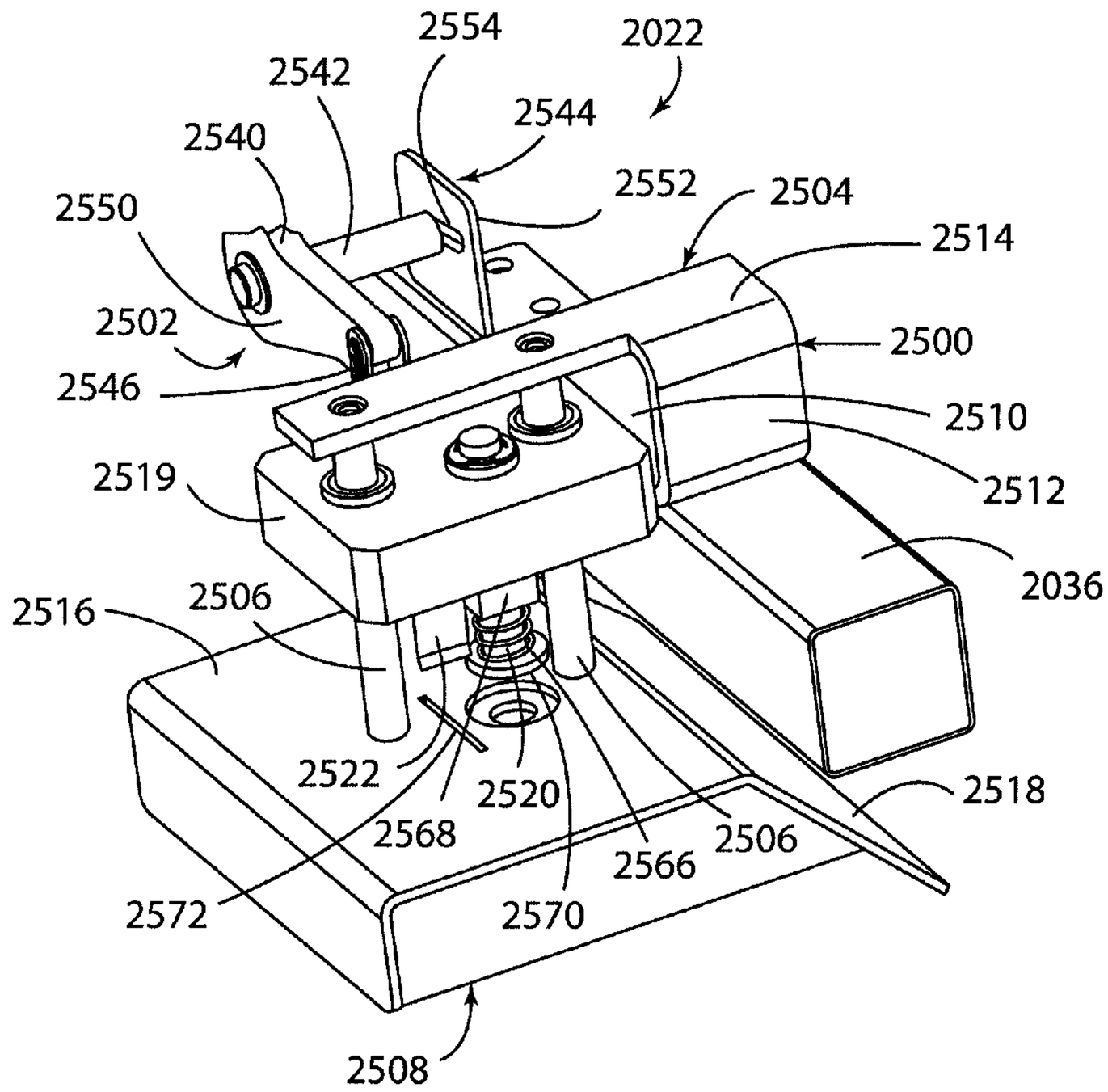


FIG. 45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2022
2542
2544
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2552
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2514
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2516
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2508

FIG. 43

STRETCH WRAP MACHINE WITH TOP CORNER FILM TRANSFER

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation of U.S. patent application Ser. No. 11/744,012 entitled STRETCH WRAP MACHINE WITH TOP CORNER FILM TRANSFER, which was filed on May 3, 2007, now U.S. Pat. No. 7,775,016, which claimed priority to U.S. Provisional Patent Application No. 60/821,162, entitled STRETCH WRAP MACHINE WITH OVERHEAD GRIPPING PLATES, which was filed on Aug. 2, 2006 and was a continuation-in-part of PCT Application No. PCT/IB2005/004121, entitled STRETCH WRAP MACHINE WITH TOP CORNER FILM TRANSFER, which was filed on Nov. 3, 2005, which claimed priority to U.S. Provisional Patent Application No. 60/624,703, entitled STRETCH WRAP MACHINE WITH TOP CORNER FILM TRANSFER, which was filed on Nov. 3, 2004.

FIELD OF THE INVENTION

The present invention concerns stretch wrap machines, and more particularly relates to stretch wrap machines with a top corner film transfer.

BACKGROUND

Wrapping machines have been developed for wrapping plastic film around items on a pallet to retain the items for shipping and the like. Known wrapping machines include a film dispenser mounted on an arm to rotate about the pallet and thereby wrap the items on the pallet. The film dispenser may also be mounted for vertical travel such that the film is wrapped around the items in a spiral manner. Other known wrapping machines include a rotary table upon which the pallet is placed. In this type of machine, the wrapping device is mounted to a stationary vertical structure. During the wrapping process, the table and pallet thereon are rotated, and the wrapping device travels vertically to thereby spiral wrap the items on the pallet.

Heretofore, wrapping machines have include a gripper that grips the end of the film to thereby hold the film in a proper position as it is fed from the film dispenser. Known grippers maintain the end of the film adjacent a side of the pallet and an end of the film typically has to be blown or wiped against the side of the product on the pallet at the end of the wrapping process. During the wrapping process, the gripper remains outside of the external vertical periphery of the pallet.

A wrapping machine is desired making improvements on the aforementioned known wrapping machines.

SUMMARY OF THE PRESENT INVENTION

An aspect of the present invention is to provide a wrapping machine for wrapping a product comprising a base, a turntable on the base for rotating the product, a source of wrapping material connected to the base, the source of wrapping material supplying wrapping material to the product and an apparatus configured to cut the wrapping material at a position above the product during wrapping of the product or after the product has been wrapped.

Another aspect of the present invention is to provide a wrapping machine for wrapping a product comprising a base, a turntable on the base for rotating the product about a first vertical axis, a source of wrapping material connected to the base, the source of wrapping material supplying wrapping material to the product, the source of wrapping material having a second vertical axis of rotation and an apparatus configured to hold a portion of the wrapping material at a position above the product as the turntable begins rotating the product.

Yet another aspect of the present invention is to provide a method of wrapping a product with wrapping material comprising holding a source of the wrapping material in a horizontally stationary position, rotating the product about a vertical axis to wrap the product with the wrapping material and positioning a leading end of the wrapping material above a top height of the product.

A further aspect of the present invention is to provide a method of wrapping a product with wrapping material comprising rotating the product and dropping an end of the wrapping material on top of the product during or after rotation.

Another aspect of the present invention is to provide a method of wrapping a product with wrapping material comprising rotating the product relative to a source of the wrapping material, wrapping the product with the wrapping material and not maintaining a leading end of the wrapping material stationary relative to the product during initiation of a rotation cycle of the product relative to the source of the wrapping material.

Yet another aspect of the present invention is to provide a method of wrapping a product with wrapping material comprising rotating the product relative to a source of the wrapping material, wrapping the product with the wrapping material and not maintaining a leading end of the wrapping material stationary relative to the product during initiation of a rotation cycle of the product relative to the source of the wrapping material.

These and other aspects, objects, and features of the present invention will be understood and appreciated by those skilled in the art upon studying the following specification, claims, and appended drawings.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** is a perspective view of a stretch wrap machine of the present invention in an initial position.

FIG. **2** is a front view of the stretch wrap machine of the present invention in a start position and with a cover of a column and carriage removed to show details of the machine.

FIG. **3** is top view of the stretch wrap machine of the present invention in the start position and with the cover of the column and carriage removed to show details of the machine.

FIG. **4** is top view of the stretch wrap machine of the present invention in a first rotated position at a beginning of rotation of a product and with the cover of the column and carriage removed to show details of the machine.

FIG. **5**A is top view of the stretch wrap machine of the present invention in a second rotated position and with the cover of the column and carriage removed to show details of the machine.

FIG. **5**B is a front view of the stretch wrap machine of the present invention in a wrapping position.

FIG. **5**C is a front view of the stretch wrap machine of the present invention in an end of wrapping position.

FIG. **5**D is a perspective view of the stretch wrap machine of the present invention in a final position.

FIG. **6** is a front view of an arm of a wrapping assembly and an I-beam of the present invention.

FIG. **7** is a top view of the arm of the wrapping assembly and the I-beam of the present invention.

FIG. **8** is a side view of the arm of the wrapping assembly and the I-beam of the present invention.

FIG. **8**A is a perspective view of the arm of the wrapping assembly of the present invention.

FIG. **9** is a side view of a track, a vehicle and a cantilever beam of the arm of the wrapping assembly of the present invention.

FIG. **10** is a front view of the track and a vehicle of the wrapping assembly of the present invention.

FIG. **11** is a close-up view of the track and the vehicle taken from the circle XI of FIG. **10**.

FIG. **12** is a close-up view of the track and the vehicle taken from the circle XII of FIG. **10**.

FIG. **13** is a top view of the track of the wrapping assembly of the present invention.

FIG. **14** is a close-up top view of a motor support and transition section of the track of the wrapping assembly of the present invention.

FIG. **15**A is a top view of the stretch wrap machine of a second embodiment of the present invention.

FIG. **15**B is a top view of an end of the arm and track of the wrapping assembly of the second embodiment of the present invention.

FIG. **15**C is a front view of the stretch wrap machine of the second embodiment of the present invention.

FIG. **15**D is a side view of a track, a vehicle and a cantilever beam of the arm of the wrapping assembly of the second embodiment of the present invention.

FIG. **16** is a front of a bottom of the track of the second embodiment of the present invention.

FIG. **16**A is a front view of the end of the track and the vehicle of the second embodiment of the present invention.

FIG. **17** is a perspective view of an end of the track and the vehicle of a third embodiment of the present invention, with the vehicle in a first position on the track.

FIG. **18** is a perspective view of the end of the track and the vehicle of a third embodiment of the present invention, with the vehicle in a second position on the track.

FIG. **19** is a front perspective view of the vehicle of the third embodiment of the present invention.

FIG. **20** is a rear perspective view of the vehicle of the third embodiment of the present invention.

FIG. **21** is a front view of a fourth embodiment of the stretch wrap machine of the present invention.

FIG. **22** is a top view of the fourth embodiment of the stretch wrap machine of the present invention.

FIG. **23** is a fragmentary front view of a stationary arm and a rotating arm of the stretch wrap machine of the present invention.

FIG. **24** is a perspective view of a fifth embodiment of the stretch wrap machine of the present invention in a loading position.

FIG. **25** is a front view of the fifth embodiment of the stretch wrap machine of the present invention in the loading position.

FIG. **26** is front view of the fifth embodiment of the stretch wrap machine of the present invention in the loading position and with no product on the stretch wrap machine.

FIG. **27** is front view of the fifth embodiment of the stretch wrap machine of the present invention in a start position.

FIG. **28** is top schematic view of the fifth embodiment of the stretch wrap machine of the present invention during rotation of a product through 450° of rotation.

FIG. **29** is a side view of gripping plates of the fifth embodiment of the stretch wrap machine of the present invention.

FIG. **30** is a bottom view of a top plate of the gripping plates of the fifth embodiment of the stretch wrap machine of the present invention.

FIG. **31** is a top view of a bottom plate of the gripping plates of the fifth embodiment of the stretch wrap machine of the present invention.

FIG. **32** is front view of the fifth embodiment of the stretch wrap machine of the present invention in a first proximate to end position.

FIG. **33** is top view of the fifth embodiment of the stretch wrap machine of the present invention in a second proximate to end position.

FIG. **34** is a front view of a sixth embodiment of the stretch wrap machine of the present invention.

FIG. **35** is a top view of the sixth embodiment of the stretch wrap machine of the present invention.

FIG. **36** is a fragmentary front view of a stationary arm and a rotating arm of the sixth embodiment of the stretch wrap machine of the present invention.

FIG. **37** is a front view of a wrapping apparatus of a seventh embodiment of the stretch wrap machine of the present invention.

FIG. **38** is an enlarged front view of an end of the wrapping apparatus of the seventh embodiment of the stretch wrap machine of the present invention.

FIG. **39** is an enlarged rear view of the end of the wrapping apparatus of the seventh embodiment of the stretch wrap machine of the present invention.

FIG. **40** is a top view of the wrapping apparatus of the seventh embodiment of the stretch wrap machine of the present invention.

FIG. **41** is an end view of the wrapping apparatus of the seventh embodiment of the stretch wrap machine of the present invention.

FIG. **42** is a cross-sectional view of the wrapping apparatus of the seventh embodiment of the stretch wrap machine of the present invention taken along the line XLII-XLII of FIG. **38**.

FIG. **43** is perspective view of the end of the wrapping apparatus of the seventh embodiment of the stretch wrap machine of the present invention.

FIG. **44** is an enlarged view of the end of the wrapping apparatus of the seventh embodiment of the stretch wrap machine of the present invention in a capture position.

FIG. **45** is an end of the wrapping apparatus of the seventh embodiment of the stretch wrap machine of the present invention in the capture position.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

For purposes of description herein, the terms "upper," "lower," "right," "left," "rear," "front," "vertical," "horizontal," and derivatives thereof shall relate to the invention as orientated in FIG. **1**. However, it is to be understood that the invention may assume various alternative orientations, except where expressly specified to the contrary. It is also to be understood that the specific devices and processes illustrated in the attached drawings, and described in the following specification are simply exemplary embodiments of the inventive concepts defined in the appended claims. Hence, specific dimensions and other physical characteristics relating to the embodiments disclosed herein are not to be considered as limiting, unless the claims expressly state otherwise.

The reference number **10** (FIGS. **1**-**5**D) generally designates a stretch wrap machine embodying the present invention. In the illustrated example, the stretch wrap machine **10** is for wrapping a product **12** and comprises a base **14**, a turntable **16** on the base **14** for rotating the product **12**, a source **18** of stretch wrap **20** connected to the base **14** and a wrapping assembly **22**. The wrapping assembly **22** is config-

ured to bring a portion **24** of the stretch wrap **20** above the product **12**, cut the stretch wrap **20** at a position above the product **12** after the product **12** has been wrapped and/or hold the portion **24** of the stretch wrap **20** at a position above the product **12** as the turntable **16** begins rotating the product **12**.

FIG. **1** illustrates the stretch wrap machine **10** in an initial position. In the initial position, a product **12** that has not been wrapped yet is placed on the turntable **16**. Furthermore, the wrapping assembly **22** is located above the product **12** to allow the product **12** to be placed on the turntable **16** without interference with the wrapping assembly **22**. As illustrated in FIG. **1**, the stretch wrap **20** extends between the source **18** of stretch wrap **20** and a vehicle **38** (described in more detail below). The vehicle **38** in FIG. **1** holds the portion **24** of the stretch wrap **20** comprising a leading end **24'** of the stretch wrap **20**. Thereafter, the wrapping assembly **22** lowers as illustrated in FIGS. **2** and **3** to position the stretch wrap machine **10** in a start position for beginning to wrap the product **12**. In the start position, the stretch wrap **20** forms into a first triangular part **25** and a second rope part **27**, with the stretch wrap **20** forming a rope transition point **29** between the first triangular part **25** and the second rope part **27** on a top corner **31** of the product **12**.

The stretch wrap machine **10** then begins to wrap the product **12** by rotating the turntable **16** as illustrated in FIG. **4**. At first, the rope transition point **29** will move along the top corner **31** of the product **12**. However, when the rope transition point **29** meets a corner **200** of the product **12**, the rope transition point **29** will catch on the corner **200** and move therewith as illustrated in FIG. **5**A, thereby beginning to wrap the product **12** with the stretch wrap **12**. The source **18** of stretch wrap **20** will then begin to move vertically to wrap the sides of the product **12**. After the product **12** has been wrapped at least one time (including after the product **12** has been completely wrapped), the leading end **24'** of the stretch wrap **20** will drop onto the top of the product **12**. Thereafter, the vehicle **38** will move to a bottom of the wrapping assembly **22** as illustrated in FIG. **5**B.

To finish wrapping the product **12** in the illustrated example, the vehicle **38** will move upward and grab the portion **24** of the stretch wrap **20**. At this point, the portion **24** includes a trailing end **24"** of the stretch wrap **20** about the product **12** and a second leading end **24'** of the stretch wrap (i.e., a leading end **24'** for the stretch wrap **20** for a subsequent product to be wrapped). The portion **24** is moved above the product **12** as illustrated in FIG. **5**C. Thereafter, the portion **24** is cut to thereby drop the trailing end **24"** on top of the product **12**. Accordingly, the portion **24** is cut at a position above the product **12** such that a cutting line **2000** parallel to an axis of rotation **2002** of the turntable **16** extends through the portion **24** and the product **12** when the portion **24** is cut. The product **12** is therefore fully wrapped and can be removed from the turntable **16** and the wrapping machine **10** is positioned again in the initial position of FIG. **1**. As used herein, the portion **24** of the stretch wrap **20** can comprise the leading end **24'**, the trailing end **24"** or a combination of both the leading end **24'** and the trailing end **24"**. The elements of the illustrated embodiment the stretch wrap machine **10** will now be described.

In the illustrated example, the base **14** includes the turntable **16** for rotating the product **12** and a column **26** supporting the source **18** of stretch wrap **20** and the wrapping assembly **22**. The turntable **16** is preferably circular and configured to have the product **12** placed thereon. The turntable **16** is connected to a motor **28** preferably via an endless band (e.g., a chain) that is activated to rotate the turntable **16**. However, it is contemplated that the turntable **16** can be connected to the motor **28** using other means. The motor **28** is operatively connected to a control system (not shown) that rotates the turntable **16** during the wrapping process. The base **14** and turntable **16** are well known to those skilled in the art.

The illustrated column **26** extends upwardly from the base **14** and has the source **18** of stretch wrap **20** connected thereto. The source **18** of stretch wrap **20** is located on a carriage **30** that moves the source **18** of stretch wrap **20** vertically between a position above a top and a bottom of the product **12** in order to wrap the product **12**. Preferably, the source **18** of stretch wrap **20** includes a roll **32** of stretch wrap **20** placed on the carriage **30**. The carriage **30** preferably prestretches the stretch wrap **20** in order to lengthen the stretch wrap **20** in a manner known to those skilled in the art. The carriage **30** can be moved vertically on the column **26** by many methods, all of which are well known to those skilled in the art. The carriage **30** also includes a source of power connected thereto in a manner well known to those skilled in the art. The carriage and its manner of loading and moving on the column are conventional and well known to those skilled in the art.

In the illustrated example, the wrapping assembly **22** uses the stretch wrap **20** from the source **18** of stretch wrap **20** to wrap the product **12**. The wrapping assembly **22** includes an arm **34** extending from the column **26**, a track **36** connected to the arm **34** and a vehicle **38** that travels along the track **36** to bring the portion **24** of the stretch wrap **20** to a position above the turntable **16** after a first product is wrapped and before a second product **12** is wrapped. The vehicle **38** also cuts the portion **24** of the stretch wrap **20** after the product **12** has been wrapped.

The illustrated arm **34** (FIGS. **6**-**8**A) moves vertically along the column **26** to move the track **36** and the vehicle **38** vertically. The arm **34** of the wrapping assembly **22** rides on an I-beam **40** of the column **26**. Preferably, the carriage **30** also rides on the I-beam **40** such that the arm **34** of the wrapping assembly **22** can be connected to the existing structure of currently manufactured wrapping machines (that had previously been made without the wrapping assembly **22** of the present invention.) The I-beam **40** includes a front plate **42** upon which the arm **34** rides and a centrally located and vertically aligned ratchet plate **44** on the front plate **42**. As discussed in more detail below, the arm **34** interconnects with the ratchet plate **44** to stop the lowering of the aim **34**.

In the illustrated example, the arm **34** includes a guide plate **46** that rides on the front plate **42** of the I-beam **40**. The guide plate **46** includes a front panel **48** and a pair of three-pronged roller guides **50** on each side of the front panel **48**. The three-pronged roller guide portion **50** each include three pockets **52** having a roller **54** therein. The rollers **54** in the roller guide portions **50** are configured to roll on a front side, a rear side and an end edge of each side of the front plate **42** of the I-beam **40**. In FIG. **7**, a top of the housing enclosing the rollers **54** is removed to show the rollers **54**. Accordingly, two of the rollers **54** are parallel and the third roller **54** (the roller rolling on the end edge of the front plate **42**) is orientated perpendicular to the parallel rollers **54**. The front panel **48** of the guide plate **46** of the arm **34** includes a stopping mechanism **56** connected thereto. The stopping mechanism **56** includes a solenoid **58** and a pawl **60**. The pawl **60** is rotatably connected to the front panel **48** and is rotated through actuation of the solenoid **58**. The pawl **60** is configured to extend through an opening **62** (see FIG. **8**) in the front panel **48**. During use of the wrapping assembly **22**, the control system for the stretch wrap machine **10** will activate the solenoid **58** to rotate the pawl **60** through the opening **62** and into contact with the ratchet plate **44** to stop downward movement of the arm **34**. Preferably, the pawl **60** will only prevent downward

movement of the arm **34**, but will allow the arm **34** to move upwards. Although an embodiment of the stretch wrap machine **10** including the I-beam **40** and the guide plate **46** for moving the arm **34** and a solenoid **58** and pawl **60** for stopping movement of the arm **34** are illustrated, it is contemplated that the arm **34** could move along the column **26** in any manner and stop vertically relative to the column **26** in any manner.

The illustrated arm **34** includes a top beam **64**, a side support beam **66**, a top support beam **68**, a cantilever beam **70** and a side beam **72** extending from the guide plate **46**. The top beam **64** extends horizontally from a top of the guide plate **46** and the side beam **72** extends horizontally from a lower portion of the guide plate **46**. The top beam **64** and the side beam **72** are illustrated as being parallel. The cantilever beam **70** extends forwardly from an end of the side beam **72**. The top support beam **68** extends forwardly and downwardly from an end of the top beam **64** and a central portion of the cantilever beam **70**. Furthermore, the side support beam **66** extends laterally and forwardly from a side of the guide plate **46** to a central portion of the cantilever beam **70**. The cantilever beam **70** and the side support beam **66** each include a shock absorber support **74** having a shock absorber **76** thereon. The shock absorbers **76** are configured to abut against a top of the carriage **30** such that the arm **34** rides upward and downward on the carriage **30** until the solenoid **58** actuates the pawl **60** to stop movement of the arm **34** (see FIGS. **1-2**, which show the shock absorbers **76** directly above the carriage **30**). The track **36** is connected to the cantilever beam **70**.

In the illustrated example, the vehicle **38** moves on the track **36** (FIGS. **10-14**) to bring the stretch wrap **20** to a position above the product **12**. The track **36** includes a horizontal section **78**, a vertical section **80**, and a motor support and transition section **82**. The horizontal section **78** includes a plurality of ears **84** having holes **86** therethrough for accepting fasteners to connect the horizontal section **78** of the track **36** to the cantilever beam **70**. The horizontal section **78**, the vertical section **80**, and the motor support and transition section **82** each have an inverted T-shaped cross section (see FIG. **9** showing the end of the horizontal section **78** connected to the cantilever beam **70** or the arm **34**) and define a continuous rail **88** along the bottom of the horizontal section **78** and a right side of the vertical section **80** as shown in FIG. **10**. The vehicle **38** rides along the continuous rail **88** between an outermost end **90** (FIG. **11**) of the horizontal section **78** and a lowest end **92** (FIG. **12**) of the vertical section **80** of the track **36**. Although only one vehicle **38** is used in the illustrated embodiment, FIG. **10** illustrates the vehicle **38** at both the outermost end **90** and the lowest end **92** (even though the vehicle **38** would be at only one of these locations). The track **36** includes a drive assembly **94** for moving the vehicle **38**. The drive assembly **94** includes a motor and sprocket assembly **96** on the motor support and transition section **82**, a first sprocket **98** on the outermost end **90** of the horizontal section **78**, a second sprocket **100** of the lowest end **92** of the vertical section **80**, and a chain **102** connected to the motor and sprocket assembly **96**, the first sprocket **98** and the second sprocket **100**. The motor and sprocket assembly **96** includes a motor **118** for moving a portion of the chain **102** connected to the vehicle **38** between the outermost end **90** of the horizontal section **78** and the lowest end **92** of the vertical section **80** of the track **36**.

The illustrated vehicle **38** moves along the rail **88** of the track **36** to bring the portion **24** of the stretch wrap **20** to a position above the product **12**. The vehicle **38** includes a support **120** that rides on the rail **88** and is connected to the chain **102**. The vehicle **38** also includes a finger **122** rotatably connected to the support **120**. The support **120** comprises a plate **124** with four legs **126** having rollers **127** thereon for rolling on the rail (see FIG. **9**) and surrounding the rail **88** and being connected to the chain **102**. The finger **122** extends from the plate **124** of the support **120** and includes a first portion **128** and a second portion **130** defining a pocket **132**. A torsion spring **134** provides a bias to the finger **122** to rotate the finger **122** into a lateral position (see FIG. **12**). The finger **122** includes a resilient reverse C-shaped spring wedge **135** configured to capture the stretch wrap **20** within the pocket **132** and a blade **136** for cutting a portion of the stretch wrap **20**.

During use, the stretch wrap machine **10** begins the wrapping procedure by moving the carriage **30** and the wrapping assembly **22** to an uppermost position on the column **26**. At this point, the portion **24** of the stretch wrap **20** is held within the pocket **132** of the finger **122** of the vehicle **38** of the wrapping assembly **22** by the resilient spring wedge **135** or any other spring-like member. Furthermore, the portion **24** of the stretch wrap **20** will pull the finger **122** against the bias of the torsion spring **134** such that the finger **122** will be in an aligned position (as shown in FIGS. **1**, **2**, **10** and **11**). Thereafter, the product **12** is placed on the turntable **16**, and the carriage **30** and the wrapping assembly **22**, which can ride on the carriage **30**, is lowered. The arm **34** of the wrapping assembly **22** preferably includes an electronic eye for determining a distance from the top of the product **12**. The electronic eye will activate the solenoid **58**, which will rotate the pawl **60** into contact with the ratchet plate **44** to prevent any further downward movement of the arm **34**, when the arm **34** is a predetermined distance above the product **12** (see FIG. **2**). At this point, the stretch wrap machine **10** is ready to begin wrapping the product **12** with the stretch wrap **20**.

In the illustrated example, after the arm **34** has been lowered to the position above the product **12**, the turntable **16** will begin to rotate (see FIGS. **4** and **5**A). As the turntable **16** rotates, the corner **200** of the product **12** will catch the rope transition point **29** of the stretch wrap **20** between the vehicle **38** and the source **18** of stretch wrap **20** and begin pulling the stretch wrap **20** around the product **12**. Furthermore, the carriage **30** will move the source **18** of stretch wrap **20** vertically to allow the stretch wrap **20** to surround an outside of the product **12** between a top portion and a bottom portion of the product **12**. The method of wrapping the product **12** with the stretch wrap **20** between the top portion and the bottom portion of the product **12** is well known to those skilled in the art. Furthermore, the corner **200** of the product will pull the leading end **24'** of the stretch wrap **20** out of the resilient spring wedge **135** in the pocket **132** of the finger **122** of the vehicle **38**, thereby positioning the leading end **24'** of the stretch wrap **20** to rest on the top of the product **12**. Furthermore, the vehicle **38** will move from the aligned position to the lateral position as shown in FIG. **5**B because the stretch wrap **20** is no longer working against the bias of the spring **134**.

At any time during the wrapping of the product **12** or after the product **12** is wrapped with the stretch wrap **20**, the motor **118** of the track **36** is activated to move the chain **102** and thereby the vehicle **38** from the outermost end **90** of the horizontal section **78** to the lowest end **92** of the vertical section **80** of the track **36**. If the stretch wrap **20** extending from the source **18** of stretch wrap **20** to the product **12** is in the way of the vehicle **38** as the vehicle **38** travels down the vertical section **80** of the track **36**, the finger **122** can move to the aligned position against the bias of the torsion spring **134** as the finger **122** abuts the stretch wrap **20** to allow the vehicle **38** to move past the stretch wrap **20**. Furthermore, the arm **34**

includes a deflector **1000** for moving the arm **34** away from the carriage **30** as the arm **34** passes the carriage **30**.

After the product **12** has been wrapped by the stretch wrap **20**, the motor **118** of the track **36** is activated to move the chain **102**, and thereby the vehicle **38**, up the vertical section **80** of the track **36**. As the vehicle **38** moves against the stretch wrap **20**, a top **300** of the finger **122** (see FIG. **5**B) will collect the stretch wrap **20** as the vehicle **38** will not be able to rotate out of the way of the stretch wrap **20**. Once the vehicle **38** makes a transition from the vertical section **80** of the track **36** to the horizontal section **78** of the track **36**, the stretch wrap **20** will be pulled into the pocket **132**. At this point, the vehicle **38** is still in the lateral position. However, once the stretch wrap **20** is fully inserted into the pocket **132**, the vehicle **38** will begin to rotate to the aligned position due to the pulling force of the stretch wrap **20** from the source **18** of stretch wrap **20** on one end. As the vehicle **38** rotates, the blade **136** will rotate into contact with the stretch wrap **20** located between the finger **122** and the product **12**. Therefore, the blade **136** will cut the stretch wrap **20** and place the trailing end **24"** of the stretch wrap **20** on the top of the product **12**. Accordingly, both ends of the stretch wrap surrounding the product will be on top of the product. Furthermore, the leading end **24'** of the stretch wrap **20** from the source **18** of stretch wrap **20** will be held within the finger **122** by the resilient spring wedge **135**. At this point, the product **12** can be removed from the turntable **16**, a new or second product can be placed on the turntable **16** and the process for wrapping can start again.

The reference numeral **10***a* (FIGS. **15**A-**16**A) generally designates another embodiment of the present invention, having a second embodiment for the stretch wrap machine. Since stretch wrap machine **10***a* is similar to the previously described stretch wrap machine **10**, similar parts appearing in FIGS. **1-14** and FIGS. **15**A-**16**A, respectively, are represented by the same, corresponding reference number, except for the suffix "a" in the numerals of the latter. The stretch wrap machine **10***a* is identical to the first embodiment of the stretch wrap machine **10**, except that instead of capturing the portion **24** of the stretch wrap with the resilient spring wedge **135** of the finger **122**, the finger **122***a* includes a plastic flap **502** (see FIG. **15**D) that is configured to capture the portion **24** of the stretch wrap **20** between the plastic flap **502** and a first cam **500** extending from the horizontal section **78***a* of the arm **34***a*. Therefore, as the vehicle **38***a* moves onto the horizontal section **78***a* of the arm **34***a*, one end of the stretch wrap will come out of the source of stretch wrap and another end of the stretch wrap will surround the product, and the stretch wrap in the middle will be captured between the plastic flap **502** of the finger **122***a* and the first cam **500**. It is contemplated that the vehicle **38***a* could travel almost to the outermost end **90***a* of the horizontal section **78***a* and still capture the portion of the stretch wrap **20**, but can move all of the way to the outermost end **90***a* of the horizontal section **78***a* after the wrapping procedure has begun to move the portion of the stretch wrap out of being captured between the flap **502** and the first cam **500** (because the first cam **500** will end short of the outermost end **90***a*). Furthermore, instead of the finger **122***a* rotating as it travels towards the outermost end **90** of the horizontal section **78***a* by force of the stretch wrap pulling on the finger **122***a*, the finger **122***a* will rotate against a force of a second cam **504** (located on the horizontal section **78***a* of the arm **34***a* opposite to the first cam **500**) that will abut against the finger **122***a* to rotate the finger **122***a*. Moreover, as the vehicle **38***a* moves to the end of the arm after the finger **122***a* has rotated, the knife will cut the stretch wrap as in the first embodiment. Therefore, the first cam **500** helps to hold an end of the stretch wrap from the source of stretch wrap in engagement with the vehicle **38***a* and the second cam **504** helps to rotate the finger **122***a* on the horizontal section **78***a* of the arm (instead of using only the tension of the stretch wrap as in the first embodiment) and to thereby cut the stretch wrap.

The reference numeral **10***b* (FIGS. **17-20**) generally designates another embodiment of the present invention, having a third embodiment for the stretch wrap machine. Since stretch wrap machine **10***b* is similar to the previously described stretch wrap machine **10***a*, similar parts appearing in FIGS. **15**A-**16**A and FIGS. **17-20**, respectively, are represented by the same, corresponding reference number, except for the suffix "b" in the numerals of the latter. The stretch wrap machine **10***b* is identical to the second embodiment of the stretch wrap machine **10***a*, except with a modified vehicle **38***b* and arm **34***b*. The arm **34***b* of the third embodiment of the stretch wrap machine **10***b* includes a first cam **500***b* and a second cam **504***b*. The second cam **504***b* includes a beveled front edge **600** and a wrap collection member **602**. The wrap collection member **602** extends from the bottom of the second cam **504***b* and includes a wrap collection slot **604** for collecting an end portion of the wrap when the wrap is cut as described in more detail below.

The illustrated vehicle **38***b* includes holds the wrap as described above in the first and second embodiment of the stretch wrap machine. The vehicle **38***b* includes a support **120***b* that rides on the arm **34***b* and a finger **122***b*. The finger **122***b* is rotatably connected to the support **120***b* and includes a first portion **128***b* and a second portion **130***b*. The support **120***b* includes a first stop member **606** for stopping rotational movement of the finger **122***b* in a first direction and a second stop member **608** for stopping rotational movement of the finger **122***b* in a second direction, with the first stop member **606** and the second stop member **608** abutting the first portion **128***b* of the finger **122***b* during rotation of the finger **122***b*. The finger **122***b* also includes a blade **136***b* for cutting the wrap and a wedge member **610** for holding the wrap and to assist in cutting the wrap. The second portion **130***b* of the finger **122***b* also includes a cam member **612** for rotating the finger **122***b* when the cam member **612** abuts the beveled front edge **600** of the second cam **504***b*.

In use, the finger **122***b* of the third embodiment of the stretch wrap machine **10***b* grabs the wrap as discussed above after the turntable **16** has stopped rotating and the product **12** has been wrapped. The finger **122***b* moves upward along the vertical section **80***b* of the arm **34***b* and grabs the wrap while it moves upward. As the finger **122***b* moves onto the horizontal section **78***b* of the arm **34***b*, the cam member **612** will abut the beveled front edge **600** of the second cam **504***b*, thereby rotating the finger **122***b* to be aligned with the horizontal section **78***b* of the arm **34***b* as illustrated in FIG. **18**. As the finger **122***b* moves between the first cam **500***b* and the second cam **504***b*, the end of the wrap will be captured in the wrap collection slot **604** of the wrap collection member **602**. When the end of the wrap is trapped by the wrap collection member **602**, the vehicle **38***b* will continue to move past the wrap collection member **602** and cut the end of the wrap with the blade **136***b*, thereby dropping the end of the wrap onto the top of the product **12**. Furthermore, the portion of the wrap still connected to the source of wrap will be captured between the wedge member **610** of the finger **38***b* and the first cam **500***b*. The vehicle **38***b* will then move a position between the first cam **500***b* and the second cam **504***b* almost at the end of the first cam **500***b* and the second cam **504***b*. The arm **34***b* will then rise as discussed above, the product **12** can be removed from the turntable **16** and a new product is placed on the turntable **16**. The arm **34***b* will then lower again and the turntable **16** will begin to rotate to wrap the new product.

After at least a couple of turns of the turntable, the vehicle **38***b* will move the end **90***b* of the horizontal section **78***b* of the arm **34***b* and from out of a position between the first cam **500***b* and the second cam **504***b*, thereby dropping the end of the wrap onto the product.

The reference numeral **10***c* (FIGS. **21-23**) generally designates another embodiment of the present invention, having a fourth embodiment for the stretch wrap machine. Since stretch wrap machine **10***c* is similar to the previously described stretch wrap machine **10**, similar parts appearing in FIGS. **1-14** and FIGS. **21-23**, respectively, are represented by the same, corresponding reference number, except for the suffix "c" in the numerals of the latter. The stretch wrap machine **10***c* of the fourth embodiment of the present invention does not include a turntable. The stretch wrap machine **10***c* of the fourth embodiment of the present invention includes a rotating **704** that has the source **18***c* of stretch wrap **20***c* thereon, with the arm **704** rotating about the product **12***c* to wrap the product **12***c*.

In the illustrated embodiment, the stretch wrap machine **10***c* includes a vertical column **700** fixed to a floor and a cantilever arm **702** extending horizontally from the vertical column **700**. The rotating arm **704** is rotatably connected to an end of the cantilever arm **702** by a pivot pin **711**. A motor and gear assembly **706** on the cantilever arm **702** rotates the pivot pit **711** to thereby rotating the rotating arm **704**. The rotating arm **704** includes a vertical section **714** having a clearance member **712** at a bottom thereof and a horizontal section **716**, with the carriage **30***c* configured to move vertically on the vertical section **714** to wrap the product **12***c* as the rotating arm **704** rotates about the product **12***c*. The vertical column **700**, the cantilever arm **702**, the pivot pin **711**, the motor and gear assembly **706**, the rotating arm **704**, the clearance member **712** and the movement of the carriage **30***c* on the vertical section **714** of the rotating aim **704** are well known to those skilled in the art.

The illustrated fourth embodiment of the stretch wrap machine **10***c* further includes the wrapping assembly **22***c* on the vertical section **714** of the rotating arm **704**. The wrapping assembly **22***c* can comprise any one of the wrapping assemblies described above in the first, second and third embodiments of the stretch wrap machine described above. In the illustrated embodiment, an end of the horizontal section **716** includes a motor **708** having a linking member **710** connected thereto. The linking member **710** extends from the motor **708**, around a wheel **730** at a junction between the horizontal section **716** and the vertical section **714** of the rotating arm **704**, and connects to the carriage **30***c*. The motor **708** is configured to wind and unwind the linking member **710** to move the carriage **30***c* vertically on the vertical section **714** of the rotating arm **704**. As described above, the wrapping assembly **22***c* is configured to ride on the carriage **30***c*.

The reference number **1010** (FIGS. **24-27**, **32** and **33**) generally designates a fifth embodiment of the stretch wrap machine embodying the present invention. In the illustrated example, the stretch wrap machine **1010** is for wrapping a product **1012** and comprises a base **1014**, a turntable **1016** on the base **1014** for rotating the product **1012**, a source **1018** of stretch wrap **1020** connected to the base **1014** and a wrapping apparatus **1022**. The wrapping apparatus **1022** is configured to cut the stretch wrap **1020** at a position above the product **1012** after the product **1012** has been wrapped and/or hold a portion **1024** of the stretch wrap **1020** at a position above the product **1012** as the turntable **1016** begins rotating the product **1012**.

In the illustrated example, the base **1014** includes the turntable **1016** for rotating the product **1012** and a column **1026** supporting the source **1018** of stretch wrap **1020** and the wrapping apparatus **1022**. The turntable **1016** is configured to have the product **1012** placed thereon. While the turntable **1016** is illustrated as being circular, it is contemplated that any shape could be employed. The turntable **1016** is connected to a motor (not shown) that is activated to rotate the turntable **1016**. It is contemplated that the turntable **1016** can be connected to the motor using any means. The motor is operatively connected to a control system (not shown) that rotates the turntable **16** during the wrapping process. The base **1014** and turntable **1016** are well known to those skilled in the art.

The illustrated column **1026** extends upwardly from the base **1014** and has the source **1018** of stretch wrap **1020** connected thereto. The source **1018** of stretch wrap **1020** is located on a carriage **1030** that moves the source **1018** of stretch wrap **1020** vertically between a position above a top and a bottom of the product **1012** in order to wrap the product **1012**. Preferably, the source **1018** of stretch wrap **1020** includes a roll of stretch wrap **1020** placed on the carriage **1030**. The carriage **1030** preferably prestretches the stretch wrap **1020** in order to lengthen the stretch wrap **1020** in a manner known to those skilled in the art. However, it is contemplated that the carriage **1030** does not prestretch the stretch wrap **1020**. The carriage **1030** can be moved vertically on the column **1026** by many methods, all of which are well known to those skilled in the art. The carriage **1030** also includes a source of power connected thereto in a manner well known to those skilled in the art. The carriage and its manner of loading and moving on the column are conventional and well known to those skilled in the art.

In the illustrated example, the wrapping apparatus **1022** uses the stretch wrap **1020** from the source **1018** of stretch wrap **1020** to wrap the product **1012**. The wrapping apparatus **1022** includes an arm **1034** extending from the column **1026** that moves vertically in a line substantially parallel to the movement of the carriage **1030**. The arm **1034** includes a substantially horizontal member **1036** that moves within a substantially vertical slot **1038** in the column **1026**. The arm **1034** includes an inverted L-shaped member **1040** extending from the horizontal member **1036**, a pivot member **1042** extending downwardly from the horizontal member **1036** and gripping plates **1044** extending downwardly from an end of the horizontal member **1036**. In the illustrated example, the arm **1034** includes a support beam **1046** connected to the top of the horizontal member **1036** for supporting the horizontal member **1036**. The support beam **1046** also is configured to move within the slot **1038** in the column **1026**. However, it is contemplated that the wrapping apparatus **1022** could include additional support beams or no support beams for the horizontal member **1036**.

As illustrated in FIG. **26**, the wrapping apparatus **1022** includes a projection **1111** configured to ride on a mating projection **1113** extending from the carriage **1030**. Therefore, when the carriage **1030** raises, the projection **1113** of the carriage **1030** will abut against the projection **1111** of the wrapping apparatus **1022** to raise the wrapping apparatus **1022**. Furthermore, when the carriage **1030** lowers, the wrapping apparatus **1022** will also lower until the pivot member **1042** abuts against a top of the product **1012** as discussed in more detail below. The wrapping apparatus **1022** can include elements to prevent binding of the wrapping apparatus **1022** as it moves vertically as are well known to those skilled in the art. It is contemplated that the wrapping apparatus **1022** could include its own motor to move the wrapping apparatus **1022** vertically instead of having the wrapping apparatus **1022** ride on the carriage **1030**. In the illustrated embodiment, the arm

1034 is located to the left of the carriage 1030. However, it is contemplated that the arm 1034 could be located to the right of the carriage 1030 and/or could be supported by its own column.

The illustrated arm 1034 uses the pivot member 1042 to support the arm 1034 on the product 1012. Furthermore, the illustrated arm 1034 uses the inverted L-shaped member 1040 and the gripping plates 1044 and to hold or abut the stretch wrap 1020. The inverted L-shaped member 1040 includes a vertical portion 1048 and a horizontal portion 1050. The horizontal portion 1050 extends substantially perpendicular to the vertical portion 1048 and the horizontal member 1036 of the arm 1034. The horizontal portion 1050 extends in a direction towards the carriage 1030. The pivot member 1042 includes a post 1052 extending downwardly from the horizontal member 1036 of the arm 1034 and a spinning plate 1054 at a bottom of the post 1052. The spinning plate 1054 is configured to spin freely relative to the post 1052. The gripping plates 1044 comprise an upper plate 1056 and a lower plate 1058.

As illustrated in FIGS. 29-31, the upper plate 1056 and the lower plate 1058 are connected to a rod 1060 extending downwardly from the end of the horizontal member 1036 of the arm 1034. The lower plate 1058 is fixed in position at the end of the rod 1060 and the upper plate 1056 is biased towards the lower plate 1058 by a spring 1061. The upper plate 1056 includes a downwardly and inwardly tapered outer surface 1063 and the lower plate 1058 includes an upwardly and inwardly tapered outer surface 1065. The outer surfaces 1063 and 1065 assist in inserting a rope of the stretch wrap 1020 between the upper plate 1056 and the lower plate 1058 as described in more detail below. As illustrated in FIGS. 29 and 31, the lower plate 1058 includes a cutting blade 1100 extending towards the upper plate 1056. The cutting blade 1100 is configured to be inserted into a slot 1201 in a lower face of the upper plate 1056 and the upper plate 1056 and the lower plate 1058 come together under the force of the spring 1061.

FIGS. 24-26 illustrate the stretch wrap machine 1010 in a start position. In the start position, a product 1012 that has not been wrapped yet is placed on the turntable 1016. Furthermore, the arm 1034 of the wrapping apparatus 1022 is located above the product 1012 to allow the product 1012 to be placed on the turntable 1016 without interference with the wrapping assembly 1022. As illustrated in FIGS. 24-26, the stretch wrap 1020 extends from the source 1018 of stretch wrap 1020, under the horizontal portion 1050 of the inverted L-shaped member 1040 and between the gripping plates 1044. The gripping plates 1044 hold the portion 1024 of the stretch wrap 1020 comprising a leading end 1024' of the stretch wrap 1020 between the upper plate 1056 and the lower plate 1058.

Thereafter, the wrapping apparatus 1022 lowers as illustrated in FIG. 27 to position the stretch wrap machine 1010 in a start position for beginning to wrap the product 1012. In the start position, the spinning plate 1054 of the pivot member 1042 rests on a top of the product 1012 to support the arm 1034 and to hold the product in position 1012. Preferably, the center of rotation of the spinning plate 1054 is co-linear with the center of rotation of the turntable 1016. Furthermore, the carriage 1030 is lowered below the arm 1034 and a bottom of the source of stretch wrap is lowered below a top of the product. Therefore, the stretch wrap 1020 forms into a first triangular part 1025 and a second rope part 1027, with the stretch wrap 1020 forming a rope transition point 1029 between the first triangular part 1025 and the second rope part 1027 on a top corner 1031 of the product 1012.

The stretch wrap machine 1010 then begins to wrap the product 1012 by rotating the turntable 1016 as illustrated in FIG. 28. FIG. 28 illustrated the product 1012 during 450° of rotation of the product 1012 on the turntable 1016 at the following angles of rotation: (a) 0°, (b) 45°, (c) 90°, (d) 135°, (e) 180°, (f) 225°, (g) 270°, (h) 315°, (i) 360°, (j) 405° and (k) 450°. FIG. 28 also illustrates the leading end 1024' of the stretch wrap 1020, the gripping plates 1044, the vertical portion 1048 of the inverted L-shaped member 1040 and the stretch wrap 1020 as it leads back to the source 1018 of stretch wrap 1020.

At first, the rope transition point 1029 will move along the top corner 1031 of the product 1012. However, when the rope transition point 1029 meets a corner 1200 of the product 1012, the rope transition point 1029 will catch on the corner 1200 and move therewith as illustrated in FIG. 28(*c*), thereby beginning to wrap the product 1012 with the stretch wrap 1020. The source 1018 of stretch wrap 1020 will then begin to move vertically to wrap the sides of the product 1012. As illustrated in FIG. 28(*j*), after the product 1012 has been wrapped at least one time, the stretch wrap 1020 extending between the gripping plates 1044 and the corner 1200 will abut the vertical portion 1048 of the inverted L-shaped member 1040. After further rotation as illustrated in FIG. 28(*k*), the stretch wrap 1020 will begin to pull against the vertical portion 1048 of the inverted L-shaped member 1040, thereby pulling the leading end 1024' of the stretch wrap 1020 out of the gripping plates 1044 and dropping the leading end 1024' of the stretch wrap 1020 onto the top of the product 1012.

To finish wrapping the product 1012 in the illustrated example, the carriage 1030 will move upward above a top of the arm 1034 as illustrated in FIG. 32. As the carriage 1030 moves above the arm 1034, the stretch wrap 1020 will be collected under the horizontal portion 1050 of the inverted L-shaped member 1040, thereby forming the stretch wrap 1020 into a rope between a bottom of the horizontal portion 1050 of the inverted L-shaped member 1040 and the corner 1200 as illustrated in FIG. 32. The turntable 1016 will continue to rotate and the rope will be inserted between the gripping plates 1044. As the turntable 1016 continues to rotate, the stretch wrap 1020 between the gripping plates 1044 and the corner 1200 will abut against the cutting blade 1100 as illustrated in FIG. 33, thereby cutting the stretch wrap 1020 and forming a trailing end 1024" of the stretch wrap 1020 and a second leading end 1024' of the stretch wrap (i.e., a leading end 1024' for the stretch wrap 1020 for a subsequent product to be wrapped). Moreover, as the turntable 1016 continues to rotate further, the trailing end 1024" will be pulled out of the gripping plates 1044, thereby dropping the trailing end 1024" on top of the product 1012. The product 1012 is therefore fully wrapped and can be removed from the turntable 1016 and the wrapping machine 1010 is positioned again in the initial position of FIG. 24. As used herein, the portion 1024 of the stretch wrap 1020 can comprise the leading end 1024', the trailing end 1024" or a combination of both the leading end 1024' and the trailing end 1024".

The reference numeral 1010*a* (FIGS. 34-36) generally designates another embodiment of the present invention, having a sixth embodiment for the stretch wrap machine. Since stretch wrap machine 1010*a* is similar to the previously described stretch wrap machine 1010, similar parts appearing in FIGS. 24-33 and FIGS. 34-36, respectively, are represented by the same, corresponding reference number, except for the suffix "a" in the numerals of the latter. The stretch wrap machine 1010*a* of the sixth embodiment of the present invention does not include a turntable. The stretch wrap machine 1010*a* of the second embodiment of the present invention

includes a rotating arm **1704** that has the source **1018***a* of stretch wrap **1020***a* thereon, with the arm **1704** rotating about the product **1012***a* to wrap the product **1012***a*.

In the illustrated embodiment, the stretch wrap machine **1010***a* includes a vertical column **1700** fixed to a floor and a cantilever arm **1702** extending horizontally from the vertical column **1700**. The rotating arm **1704** is rotatably connected to an end of the cantilever arm **1702** by a pivot pin **1711**. A motor and gear assembly **1706** on the cantilever arm **1702** rotates the pivot pit **1711** to thereby rotate the rotating arm **1704**. The rotating arm **1704** includes a vertical section **1714** having a clearance member **1712** at a bottom thereof and a horizontal section **1716**, with the carriage **1030***a* configured to move vertically on the vertical section **1714** to wrap the product **1012***c* as the rotating arm **1704** rotates about the product **1012***c*. The vertical column **1700**, the cantilever arm **1702**, the pivot pin **1711**, the motor and gear assembly **1706**, the rotating arm **1704**, the clearance member **1712** and the movement of the carriage **1030***a* on the vertical section **1714** of the rotating arm **1704** are well known to those skilled in the art.

The illustrated sixth embodiment of the stretch wrap machine **1010***a* further includes the wrapping apparatus **1022***a* on the vertical section **1714** of the rotating arm **1704**. The wrapping apparatus **1022***a* comprises the wrapping assembly described above. In the illustrated embodiment, an end of the horizontal section **1716** includes a motor **1708** having a linking member **1710** connected thereto. The linking member **1710** extends from the motor **1708**, around a wheel **1730** at a junction between the horizontal section **1716** and the vertical section **1714** of the rotating arm **1704**, and connects to the carriage **1030***a*. The motor **1708** is configured to wind and unwind the linking member **1710** to move the carriage **1030***a* vertically on the vertical section **1714** of the rotating arm **1704**. As described above, the wrapping apparatus **1022***a* is configured to ride on the carriage **1030***a*.

The reference numeral **2010** (FIGS. **37-45**) generally designates another embodiment of the present invention, having a seventh embodiment for the stretch wrap machine. Since stretch wrap machine **2010** is similar to the previously described stretch wrap machine **1010**, similar parts appearing in FIGS. **24-33** and FIGS. **37-45**, respectively, are represented by the same, corresponding reference number, except that numerals of the latter are in the two thousands instead on the one thousands of the former. In the illustrated example, the stretch wrap machine **2010** is for wrapping a product and comprises a base, a turntable on the base for rotating the product, a source of stretch wrap connected to the base and a wrapping apparatus **2022**. The wrapping apparatus **2022** is configured to cut the stretch wrap at a position above the product after the product has been wrapped and/or hold a portion of the stretch wrap at a position above the product as the turntable begins rotating the product in the same manner as in the fifth embodiment of the stretch wrap machine **1010** described above. The seventh embodiment of stretch wrap machine **2010** includes a different wrapping apparatus **2022** than the wrapping apparatus **1022** of the fifth embodiment of the stretch wrap machine **1010**.

In the illustrated example, the wrapping apparatus **2022** uses the stretch wrap from the source of stretch wrap to wrap the product. The wrapping apparatus **2022** includes an arm **2034** extending from the column that moves vertically in a line substantially parallel to the movement of the carriage. The arm **2034** includes a substantially horizontal member **2036** that moves within a substantially vertical slot in the column. Although not shown, the arm **2034** could include an inverted L-shaped member extending from the horizontal member **2036** and a pivot member extending downwardly from the horizontal member **2036**, similar to the inverted L-shaped member **1040** and the pivot member **1042** of the fifth embodiment of the stretch wrap machine **1010** as described above. The arm **2034** also includes the wrapping apparatus **2022** extending downwardly from an end of the horizontal member **2036**. In the illustrated example, the arm **2034** includes a support beam **2046** connected to the top of the horizontal member **2036** for supporting the horizontal member **2036**. The support beam **2046** also is configured to move within the slot in the column. However, it is contemplated that the wrapping apparatus **2022** could include additional support beams or no support beams for the horizontal member **2036**.

The illustrated wrapping apparatus **2022** can include a projection configured to ride on a mating projection extending from the carriage as discussed above in regard to the fifth embodiment of the stretch wrap machine **1010**. The wrapping apparatus **2022** can include elements to prevent binding of the wrapping apparatus **2022** as it moves vertically as are well known to those skilled in the art. It is contemplated that the wrapping apparatus **2022** could include its own motor to move the wrapping apparatus **2022** vertically instead of having the wrapping apparatus **2022** ride on the carriage. The arm **2034** can be located to the left of the carriage or to the right of the carriage and/or could be supported by its own column. The illustrated arm **2034** can use a pivot member to support the arm **2034** on the product or the arm **2034** could have its own stopping mechanism interacting with the column for stopping vertical movement of the arm **2034**. Furthermore, the arm **2034** uses the wrapping apparatus **2022** and to hold or abut the stretch wrap.

As illustrated in FIGS. **37-45**, the wrapping apparatus **2022** includes a static collecting portion **2500** and a dynamic wrap holding and cutting portion **2502**. The static collection portion **2500** comprises a support bracket **2504**, a pair of vertically positioned guide pins **2506** connected to the support bracket **2504** and a bottom ramp member **2508**. The support bracket **2504** includes a bottom plate **2510** connected to a top of the horizontal member **2036** of the arm **2034** adjacent an end thereof. The support bracket **2504** also includes a vertical plate **2512** extending upward from the bottom plate **2510** and a side support plate **2514** extending from a top of the vertical plate **2512**. The side support plate **2514** extends to a position to a side of the arm **2034**. The pair of vertically positioned guide pins **2506** are connected in a parallel manner to a bottom of the side support plate **2514**. The bottom ramp member **2508** is connected to the bottom of the pair of vertically positioned guide pins **2506**. The bottom ramp member **2508** includes a top surface **2516** and a ramp surface **2518** extending downwardly from one edge of the top surface **2516**. The ramp surface **2518** is illustrated as being positioned below the arm **2034**.

In the illustrated example, the dynamic wrap holding and cutting portion **2502** of the wrapping apparatus **2022** holds the wrap during certain periods of the wrapping process and cuts the wrap during the wrapping process. The dynamic wrap holding and cutting portion **2502** includes an actuator **2517** for actuating the dynamic wrap holding and cutting portion **2502**, a sliding block **2519** interacting with the actuator **2517**, a plunger **2520** for holding the wrap and a blade **2522** for cutting the wrap.

The illustrated actuator **2517** includes a first end **2524** connected to the arm **2034** by a clevis bracket **2526** and a second end **2528** interconnected to the sliding block **2519**. The clevis bracket **2526** is substantially L-shaped and includes a horizontal portion **2530** connected to top of the arm **2034** and extending outwardly therefrom in the same direc-

tion that the side support plate **2514** of the support bracket **2504** extends from the arm **2034** and a vertical portion **2532**. The vertical portion **2532** is pivotally connected to the first end **2524** of the actuator **2517**. The actuator **2517** includes a linearly extending component **2534** configured to move in a linear direction along line **2536** at the second end **2528** of the actuator **2517**. The linearly extending component **2534** is connected to the sliding block **2519** via a linking assembly **2538**. The actuator **2517** moves the sliding block **2519** by moving the linearly extending component **2534** along the line **2536** via the linking assembly **2538**.

In the illustrated embodiment, the linking assembly **2538** includes a substantially L-shaped lever **2540**, a pivot shaft **2542**, a pivot shaft bracket **2544** and at least one link **2546**. The L-shaped lever **2540** includes a generally vertically positioned portion **2548** connected to the linearly extending component **2534** of the actuator **2517** and a generally horizontally positioned portion **2550**. The pivot shaft **2542** includes a first end connected to the L-shaped lever **2540** at the intersection of the generally vertically positioned portion **2548** and the generally horizontally positioned portion **2550** and a second end connected to the pivot shaft bracket **2544**. The pivot shaft bracket **2544** is connected to a top of the arm **2034** and includes a vertical plate **2552** having a slot **2554** therein. The second end of the pivot shaft **2542** is located in the slot **2554** and is configured to slide therein. As the linearly extending component **2534** of the actuator **2517** is extended out of the actuator **2517**, the L-shaped lever **2540** is rotated in a clockwise direction as illustrated in FIG. **38**, thereby forcing the L-shaped lever **2540** to pivot in a generally clockwise direction about the pivot shaft **2542** and forcing an end of the generally horizontally positioned portion **2550** of the L-shaped lever **2540** downward. The at least one link **2546** connects the end of the generally horizontally positioned portion **2550** of the L-shaped lever **2540** to the sliding block **2519**.

The illustrated sliding block **2519** is configured to slide on the pair of vertically positioned guide pins **2506** of the static collecting portion **2500** of the wrapping apparatus **2022**. The sliding block **2519** includes a pair of parallel openings **2556** for accepting the guide pins **2506** therein. As illustrated in FIG. **42**, a bushing **2558** can surround the guide pins **2506** within the opening **2556** for allowing the sliding block **2519** to easily slide on the guide pins **2506**. The sliding block **2519** includes a projection **2560** pivotally connected to the at least one link **2546**, thereby connecting the sliding block **2519** to the actuator **2517**. The sliding block **2519** includes an aperture **2562** having the plunger **2520** therein. The plunger **2520** is configured to slide within the aperture **2562**. As illustrated in FIG. **42**, a bushing **2564** can surround the plunger **2520** within the aperture **2562** for allowing the plunger **2520** to easily slide within the aperture **2562**. A compression spring **2566** surrounds the plunger **2520** and biases the plunger **2520** in a downward direction through the aperture **2562**. The blade **2522** is connected to the sliding block **2519** by a blade support block **2568** connected to a bottom of the sliding block **2519**.

The illustrated seventh embodiment of the stretch wrap machine **2010** operates in the same manner as the fifth embodiment of the stretch wrap machine. Therefore, in the start position, a product that has not been wrapped yet is placed on the turntable. Furthermore, the arm **2034** of the wrapping apparatus **2022** is located above the product to allow the product to be placed on the turntable without interference with the wrapping assembly. Similar to that illustrated in FIGS. **24-26**, the stretch wrap extends from the source of stretch wrap (under the horizontal portion of the inverted L-shaped member if such a member is used) and an end of the stretch wrap is captured in the wrapping apparatus **2022** between an enlarged head **2570** at a bottom of the plunger **2520** of the dynamic wrap holding and cutting portion **2502** and the top surface **2516** of the bottom ramp member **2508** of the static collecting portion **2500**. Such a capture position is illustrated in FIGS. **44** and **45**. In the capture position, the linearly extending component **2534** of the actuator **2517** extends out of the actuator **2517**, thereby rotating the L-shaped lever **2540** in a clockwise direction, forcing the L-shaped lever **2540** to pivot in a generally clockwise direction about the pivot shaft **2542**, and forcing an end of the generally horizontally positioned portion **2550** of the L-shaped lever **2540** downward. The downward force of the end of the generally horizontally positioned portion **2550** of the L-shaped lever **2540** forces the at least one link **2548** downward, thereby moving the sliding block **2519** downward along the guide pins **2506**. As the sliding block **2519** moves downward, the enlarged head **2570** at the bottom of the plunger **2520** of the dynamic wrap holding and cutting portion **2502** is moved towards the top surface **2516** of the bottom ramp member **2508** of the static collecting portion **2500**, thereby capturing the end of the stretch wrap between the enlarged head **2570** at a bottom of the plunger **2520** and the top surface **2516** of the bottom ramp member **2508**. The wrapping apparatus **2022** therefore holds the portion of the stretch wrap comprising a leading end of the stretch wrap between the plunger **2520** and the bottom ramp member **2508**.

Thereafter, the wrapping apparatus **2022** lowers to position the stretch wrap machine in a start position for beginning to wrap the product. In the start position, a spinning plate of the pivot member, if one is used, rests on a top of the product to support the arm **2034** and to hold the product in position. Alternatively, the aim **2034** can be moved into position above the product and stopped in that position using a stop mechanism in the column. Furthermore, the carriage is lowered below the arm **2034** and a bottom of the source of stretch wrap is lowered below a top of the product. Therefore, the stretch wrap forms into a first triangular part and a second rope part, with the stretch wrap forming a rope transition point between the first triangular part and the second rope part on a top corner of the product, similar to that discussed above in regard to FIG. **27**.

The stretch wrap machine **2010** then begins to wrap the product by rotating the turntable similar that that illustrated in FIG. **28**. At first, the rope transition point will move along the top corner of the product. However, when the rope transition point meets a corner of the product, the rope transition point will catch on the corner and move therewith as illustrated in FIG. **28**(*c*), thereby beginning to wrap the product with the stretch wrap. The source of stretch wrap will then begin to move vertically to wrap the sides of the product.

After the product has been wrapped at least one time, the wrapping apparatus **2022** will move to the open or release position. Such a release position is illustrated in FIGS. **37-43**. In the release position, the linearly extending component **2534** of the actuator **2517** will move back into the actuator **2517**, thereby rotating the L-shaped lever **2540** in an counter-clockwise direction, forcing the L-shaped lever **2540** to pivot in a generally counter-clockwise direction about the pivot shaft **2542**, and forcing an end of the generally horizontally positioned portion **2550** of the L-shaped lever **2540** upward. The upward force of the end of the generally horizontally positioned portion **2550** of the L-shaped lever **2540** forces the at least one link **2546** upward, thereby moving the sliding block **2519** upward along the guide pins **2506**. As the sliding block **2519** moves upward, the enlarged head **2570** at the

bottom of the plunger **2520** of the dynamic wrap holding and cutting portion **2502** is moved away from the top surface **2516** of the bottom ramp member **2508** of the static collecting portion **2500**, thereby releasing the end of the stretch wrap previously captured between the enlarged head **2570** at the bottom of the plunger **2520** and the top surface **2516** of the bottom ramp member **2508**, thereby releasing the leading end of the stretch wrap from the wrapping apparatus **2022** and allowing the leading end of the stretch wrap to drop onto the top of the product.

To finish wrapping the product in the illustrated example, the carriage will move upward above a top of the arm **2034** similar to that as illustrated in FIG. **32**. As the carriage moves above the arm **2034**, the stretch wrap will be collected on top of the top surface **2516** of the bottom ramp member **2508** via the ramp surface **2518** of the bottom ramp member **2508**. The turntable will continue to rotate and the stretch wrap, now in the form of a rope, will be inserted between the enlarged head **2570** at the bottom of the plunger **2520** and the top surface **2516** of the bottom ramp member **2508**. As the turntable continues to rotate, the wrapping apparatus **2022** will once again move to the capture position, thereby capturing the stretch wrap between the enlarged head **2570** at the bottom of the plunger **2520** of the dynamic wrap holding and cutting portion **2502** and the top surface **2516** of the bottom ramp member **2508** of the static collecting portion **2500**. Furthermore, the blade **2522** will move downward to cut the rope. As illustrated in FIG. **43**, the top surface **2516** of the bottom ramp member **2508** includes a slit **2572** for accepting the blade **2522** therein to allow the blade **2522** to cut fully through the stretch wrap in the form of a rope, thereby cutting the stretch wrap and forming a trailing end of the stretch wrap and a second leading end of the stretch wrap (i.e., a leading end for the stretch wrap for a subsequent product to be wrapped). Moreover, as the turntable continues to rotate further, the trailing end will drop on top of the product. The product is therefore fully wrapped and can be removed from the turntable and the wrapping machine **2010** is positioned again in the initial position. As used herein, the portion of the stretch wrap can comprise the leading end, the trailing end or a combination of both the leading end and the trailing end. The actuator can be activated in manners well known to those skilled in the art (including a single button that will move the turntable, the carriage, the arm and the actuator).

It is further contemplated that the seventh embodiment of the embodiment for the stretch wrap machine **2010** can be used in a machine that does not include a turntable, such as that illustrated in FIGS. **34-36**, with the wrapping apparatus **2022** being substituted for the wrapping apparatus **1022***a* of the sixth embodiment of the stretch wrapping machine **1010***a*.

It is to be understood that variations and modifications can be made on the aforementioned structure without departing from the concepts of the present invention. For example, prior art stretch wrap machines can easily be retrofitted by adding the wrapping assembly of the present invention to the prior art stretch wrap machines. Furthermore, it is contemplated that the turntable could be located on a conveyor or the rotating arm **704** could be configured to surround a product placed on a conveyor and moved thereon. Moreover, it is contemplated that the arm could include a member abutting a top of the product to prevent further downward movement of the arm instead of the pawl and associated elements. Further, it is to be understood that such concepts are intended to be covered by the following claims unless these claims by their language expressly state otherwise.

We claim:

1. A method of wrapping a product with wrapping material comprising:

holding a source of the wrapping material in a horizontally stationary position;

rotating the product about a vertical axis to wrap the product with the wrapping material;

positioning a leading end of the wrapping material above a top height of the product; and

not maintaining the leading end of the wrapping material stationary relative to the product during initiation of a rotation cycle of the product relative to the source of the wrapping material.

2. The method of wrapping a product of claim **1**, wherein:

positioning includes holding the leading end of the wrapping material during initiation of rotating the product.

3. The method of wrapping a product of claim **1**, wherein:

positioning comprising holding the leading end of the wrapping material above the top height of the product with a holding apparatus; and

further including moving the holding apparatus vertically directly above the product.

4. The method of claim **1**, further including:

dropping the leading end of the wrapping material on top of the product during or after rotation.

5. A method of wrapping a product with wrapping material comprising:

rotating the product;

wrapping sides of the product with the wrapping material;

dropping an end of the wrapping material on top of the product during or after rotation; and

not maintaining the end of the wrapping material stationary relative to the product during initiation of a rotation cycle of the product relative to the source of the wrapping material.

6. A method of wrapping a product with wrapping material comprising:

rotating the product relative to a source of the wrapping material;

wrapping the product with the wrapping material; and

not maintaining a leading end of the wrapping material stationary relative to the product during initiation of a rotation cycle of the product relative to the source of the wrapping material.

7. The method of wrapping a product of claim **6**, further including:

positioning the leading end of the wrapping material above a top height of the product;

holding a source of the wrapping material in a horizontally stationary position; and

rotating the product about a vertical axis to wrap the product with the wrapping material.

8. The method of wrapping a product of claim **6**, further including:

catching a corner of the product to begin wrapping the product.

9. The method of claim **6**, further including:

dropping the leading end of the wrapping material on top of the product during or after rotation.

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